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THE CALIFORNIA DESERT

A CRITICAL ENVIRONMENTAL CHALLENGE

Technical Supplements

California State Office
Bureau of Land Management
U.S. Department of Interior
October 1969

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This volume of 14 technical supplements is a companion to the report "The California Desert... A Critical Environmental Challenge". It provides supporting data and detailed information on the resources and uses of the California Desert and problems in their development and management.

Highlights of these individual reports are summarized in the Report. Readers who want additional details should consult the appropriate sections in this volume. And, if further information is desired, they can write to:

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The reports in this volume were prepared by technical specialists in the Bureau of Land Management and by outside consultants. They were reviewed by a group representing Federal, state, county, city, and other municipal agencies that have an interest in the development of the California Desert.

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THE SOILS RESOURCES

Most of the California Desert receives little moisture, has scant vegetation and a shallow soil mantle, is exposed to climatic extremes during parts of the year, and supports a variety of delicately balanced biological life. All of these factors contribute to the fragile nature of the Desert.

The soils here are young and immature. They have not been fully developed owing to present climatic conditions. Therefore, any soil loss caused by man's disturbance will reduce the capability of the soil to provide the necessary soil nutrients for vegetative growth. As the population increases, the need for land with soils capable of producing desert vegetation, forage and agricultural crops will increase. Thus, lands having potential for production should be identified and properly managed to conserve them for future use.

To develop a sound resource management plan compatible with intensive use of the Desert, the BLM must learn something about the nature and properties of its desert soils, the vegetation thereon, uses that can be made of the soils, and the effect climate has on the soils.

It is the physical and chemical characteristics of soil, when coupled with vegetative and climatic aspects, that can provide the Bureau with answers to the effects of (1) watershed management practices on runoff and sedimentation, (2) types of plant growth best suited for forage and protective cover, (3) road and right-of-way construction, and the construction of campsites and campgrounds, (4) landscaping, (5) proposed agricultural use, and (6) the allowance of one or more uses in certain areas of the Desert. The Bureau must acquire the necessary funds and manpower to study adequately the physical and chemical characteristics of the Desert soils, so that their utilization can be planned and controlled in a manner that will assure continued beneficial uses of the resources dependent thereon. Ignorance of their character and capabilities can not only result in the Bureau failing to prevent their deterioration for supporting biological life, but preventing the loss of vegetation so vital to desert esthetics.

AVAILABLE DATA

Reports

About 2,000,000 acres of land have been classified as arable or potential irrigable lands if water becomes available. This acreage is scattered in small parcels throughout the Desert Study Area. It is not feasible to develop this land owing to the lack of irrigation water. Should additional lands be identified as feasible for irrigation, it may be possible to extend the California Water Development Plan to cover such areas.

The Soil Conservation Service has prepared general soils reports for Imperial County and part of San Bernardino County . The total surveyed acreage is about 5,417,000 acres (Table 1). The reports are very general because the information was taken from other reports, studies and individual soil surveys. They are suitable only for general planning.

The Bureau of Reclamation has completed subreconnaissance and reconnaissance soil surveys of 2,385,923 acres of land within the Desert Study Area (Table 1). They also are very general and suitable only for planning purposes. Most of the reports for the survey areas are available. Pertinent data from the unpublished reports can be obtained from the Bureau of Reclamation, Region 3, Boulder City, Nevada.

The Bureau of Indian Affairs is conducting soil surveys upon lands within the Indian reservations.

The Army Earth Sciences Research Laboratory has published reports of flooding conditions in the Desert.

Maps

The California Region River Basin Studies Subcommittee has prepared general soils maps for the entire Desert Study Area. These maps were developed by projecting soils data from specific survey areas, other field data, and geologic inference. The soil delineations are broad and extensive. They should not be used for program development purposes, but are suitable for general planning use.

STUDIES UNDERWAY

The BLM is now developing a soil inventory program for the public desert lands. Inventory procedures have been designed to collect soils and associated data needed to make sound resource management plans.

The Bureau of Reclamation is making subreconnaissance soil surveys (general) on the inland basins in southern California to identify potentially irrigable lands should water become available. It plans to complete subreconnaissance surveys west and south of Needles, California, to add to areas already surveyed. The BLM could utilize this data for more intensive survey work in those areas.

Where the Bureau of Reclamation identifies public desert lands as suitable for irrigation, the BLM must be prepared to analyze the impact of such potential should water become available for irrigation purposes. Irrigation development would involve the granting of rights-of-way construction of roads, increased recreation pressures, zoning, homesite development near the project with attendant commercial facilities, provision of refuse disposal sites, and other problems of lands use associated with urban and rural growth.

The Soil Conservation Service is primarily concerned with soils on privately owned lands, but will also survey adjoining public lands that have agricultural potential.

Benefits

Several benefits will accrue from soil surveys. By knowing the physical, chemical, and mechanical properties of soils we will be able to determine the best land use and capabilities for that use. An inventory would help identify soils most susceptible to damage from such uses as off-road vehicular activity, uncontrolled grazing, and uncontrolled mineral exploration. In addition, we need to know if soils can be improved or damaged by this use. The only way to put a dollar value on the soil is to measure its yield in crops, forage, protective vegetative cover, water yield, and other uses.

Identifying and understanding soil capabilities will assist the BLM in resolving desert-use conflicts. The Bureau would, for example, be able to prevent recreation development in areas potentially suitable for agricultural use or too fragile for compacting by human use. It could prevent locating refuse disposal sites in areas where leaching might pollute underground water supplies or cause surface pollution of soils incapable of absorbing liquid pollutants. It could determine what capital improvements should be relocated because their location may be hazardous to human life or cause deterioration of desert environment. Soils data could also be used to provide standards of construction for improvements in particular areas.

PROPOSAL

The soils data now available are not adequate for development purposes in areas that are proposed for intensive use. A soil inventory should be completed for the 4,500,000 acres of California Desert lands where intensive use is anticipated.

Coordination

Before any soil inventory is scheduled, plans for coordination of the survey efforts must be completed because practically all of the resource data can be collected by one inventory team. The BLM soil inventory procedures contain guidelines for collecting vegetative and soils information together.

Soil inventories should be planned in order that field work will be completed ahead of development. The most satisfactory procedure would be to complete a soil inventory prior to planning. But because of the time factor, we suggest that proposed project areas should be given first priority in soil inventory.

Coordination with other agencies conducting soil surveys is necessary to avoid duplication of efforts. Because of the Bureau's personnel limitation on soil scientists, we should consider the possibility of contracting with The Soil Conservation Service, Bureau of Reclamation or universities to do the soil inventory -- provided manpower is available. But if funds become available, the work can be done in-house.

DATA NEEDED

The Bureau of Reclamation and Soil Conservation Service have issued general and reconnaissance soils reports covering 6,000,000 acres in the Desert Study Area. The data are suitable only for general planning purposes, but we should not reinventory this acreage. The reports can be used to identify problem soils, assist in soils legend development, and to plan for an intensive soil inventory program.

Data Needed

The Bureau does need soils surveys of better quality or higher intensity. A soil inventory program should be developed to collect the necessary soils data that will assist the following activities:

Watershed: to evaluate erosion, present and potential runoff, water quality and quantity, sedimentation, improvement of vegetative cover by seeding, potential for seeding, and moisture retention capacity of soils.

Range: to evaluate forage production potential, potential for seeding to increase forage, and water-holding capacity of soil for improved water yield.

Wildlife: to evaluate forage habitat suitability for wildlife and to assist in determining potential stream pollution because of soils contributing to turbidity.

Land functions: to evaluate areas suitable for agriculture and urban use in the BLM's land classification program, to assist local governments in their zoning efforts on suitable uses within a zone, and to determine value potential for BLM land appraisal functions.

Recreation: to evaluate the effects of compaction on soils from overuse, to determine suitability of soils to be used for septic tank and drain field purposes, to determine suitability of soils to be landscaped, to determine the susceptibility of soils to flooding and erosion.

Engineering: to determine engineering properties of soils before construction of improvements, to estimate soil susceptible to slipping and slouthing, and to determine soils and materials suitable for roadbed construction.

Table 1. -- Subreconnaissance and reconnaissance Soil Surveys of the Desert Study Area, California, by Agency.

Survey Area	Acres Surveyed	Arable Acreage 2/	Total Acres in County	Acres 3/ Presently Under Irrigation
	Bureau of Reclamation			
Amargosa	2,430			
Antelope and Fremont	699,250			
Borrego Valley	88,500			
Chuckwalla Valley	82,650			
Coachella	90,680			
Dos Palmas	65			
East Mesa	35,900			
Fish Springs	459			
Indian Wells - Searles	117,000			
Mesquite Valley	26,473			
Lower Colorado River W.S.	22,403			
McCoy Wash - Rice Valley and Palen	95,926			
Mojave Water Agency 1/	794,600			
Morongo-Yucca-29 Palms-Upper Coachella	107,226			
Pahrump Valley	34,984			
Panamint Valley	36,880			
Pilot Knob Mesa	15,123			
West San Bernardino Co.	4,528			
West Mesa	82,944			
Salton Area	1,339			
Sand Hills Area	36,945			
Saline Valley	9,618			
BR Subtotal	2,385,923	2,183,039		
	Soil Conservation Service			
Imperial County	2,417,000		2,950,000	654,000
Mojave Desert Area (San Bernardino County)	3,000,000		12,833,751	42,865
SCS Subtotal	5,417,000			
Subtotal	7,802,923			
1/	-1,200,000			
Total	6,602,923			

1/ Duplication of survey efforts by SCS and BR on approximately 1,200,000 acres.

2/ Arable if irrigation water becomes available.

3/ Privately owned lands.

THE WATERSHED RESOURCES

A watershed is defined as "the line of separation between two contiguous drainage valleys and/or the entire land surface from which a water channel receives its supply of water." This definition applied to the California Desert is correct inasmuch as the line of separation and entire land surface can be identified. But the implication of water does not apply to much of the 16,000,000 acres within the Desert Study Area since normal precipitation is too slight to produce surface water runoff.

The most common conception of a desert watershed is one of nearly level or undulating topography with vast expanses of unvegetated sands. Such is not the case in the California Desert, although there are several such, but relatively small, dune areas in scattered locations. Actually, elevations in the Desert range from below sea level to mountain ranges in excess of 10,000 feet elevation. In fact, 60 percent of the Desert Area is rough and mountainous and only 40 percent gently sloping or nearly level.

The Desert Study Area lies in portions of two recognized hydrologic sub-regions: South Lahontan and the Colorado Desert. The former covering about 13.5 million acres consists of large individual or multiple watersheds of the closed basin type. That is, they are wholly contained within the desert confines. These drainages end in broad, flat valleys or playas many of which seldom experience flowing or standing water. The latter group of watersheds comprising about 2.5 million acres are tributary to the Colorado River and, like the former group, surface water flows are rare and unpredictable. The largest of these drainages exceeds 147 miles long and 32 miles wide, and many of the closed basin watersheds measure 30 miles long by 15 miles wide.

Vegetation

Damage to or destruction of the perennial vegetation paves the way for erosion by wind and water. During an initial inventory of off-road vehicle use areas, 22 separate sites covering 134,000 acres and about 940 miles of trails were identified. The most apparent effect on vegetation is that occurring in parking and camping areas, starting points, and overlooks. Continued use of these areas will result in 100% denuding of the site.

One plot showed that 53% of the woody vegetative growth was destroyed or irreparably damaged, and the slow rate of growth of many of these species precludes them from being effective in wind or water control for at least 10 years. Continued use of hillclimb areas wholly eliminates vegetation from steep slopes, thereby increasing the erosion hazard rating from a slight classification to severe.

Existing inventories of vegetative types and soil movement on both disturbed and undisturbed areas are inadequate for sound management decisions at this time. Until the recently initiated Watershed Rating System is completed, the BLM will not have an adequate data base to show the inter-relationship between vegetation, climate, and soil.

Surface Water

Other than the Colorado River which borders the California Desert on the east, only three major streams are found here. The Mojave has a drainage area of about 714 square miles. The River here flows north and northeastward from the San Bernardino Mountains through the towns of Victorville and Barstow and disappears underground for most of its 147 mile length to its final destination at Soda Lake and Silver Lake. Winter snows and rains in this range average 25 plus inches annually and provide a 32 year average rate of runoff at the base of the mountains of 58,800 acre feet annually. With distribution ditches this amount is sufficient to maintain 20,000 acres of irrigated cropland in the influence of the Mojave River for a distance of 66 miles. Occasional above average snow packs, early thaws, and heavy rains combine to swell the tributaries and flood the plains and towns as far distant as Barstow.

The Amargosa River enters the east boundary from Nevada and ends in Death Valley. Water remains on the surface of the river bed only sporadically augmented periodically by exceptionally heavy storms or cloudbursts.

The Whitewater River and its tributaries flow south thru the Coachella Valley where it is diverted for irrigation and urban use, ultimately ending in the inland Salton Sea.

The U.S. Geological Survey recently completed gross estimates of water yield for the Desert Area (see Table 1). The figures may be used for general information purposes, but the data are not adequate for design of structures or land treatment measures. Most of the water yield is used on-site, either by evaporation or transpiration by plants. Because of the low rainfall, water yield improvement through overland or underground flow is not feasible.

Table 1. Estimated annual runoff from public lands administered by Bureau of Land Management in California, by county.[1]

County	Area (acres)	Annual runoff (inches)	Annual runoff (acre-feet)
Inyo	2,270,438	0.20	37,840
Kern	533,001	0.20	8,884
Total	--	--	46,724
Imperial	391,782	0.05	1,633
Riverside	1,419,154	0.05	5,913
San Bernardino	7,035,092	0.05	29,313
Total	--	--	36,859

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[1] Source: HA 212

Flood Potential

The potential danger to life is not readily apparent to the casual visitor of the Desert. A study of flood conditions in the White Mountains illustrated this vividly.[1] One 2-hour storm, restricted to the mountains only, produced depths of water and debris in the upper canyon walls of 40 to 60 feet. At the mouth of the canyon, a mass of water, mud, and boulders fanned out to an approximate 2 or more feet in depth and flowed downhill at a rate estimated at 400 to 600 feet per minute. This may be more severe than most such floods, but indicates the severity of high-intensity, short-duration summer and fall storms occurring in the normally dry desert watersheds. The possibility of such events are of primary consideration in planning permanent and semi-permanent installations or use areas.

Flooding and resulting damage to cropland and urban areas also occur periodically along existing streams, such as the Mojave River. Here, four disastrous floods occurred in 1938, 1943, 1965, and 1969. Gate heights measured approximately 21 feet, 16 feet, 14 feet and 14 feet respectively above the present gage datum. Damage to homes, farms, railroad tracks and equipment, highways, and a cement plant totalled above $2,000,000 in the 1938 flood. The 1969 flood caused more than $250,000 in similar damages.[2]

To contain the occasional flood waters and to provide for a longer time period of distribution of available water, the Bureau of Reclamation has studied the Mojave River flow. Present plans propose a dam to be located above Victorville for water storage. Capacity of the proposed reservoir is 125,000 acre-feet, which has been determined to be sufficient for minimal flood protection and controlled release for irrigated acreage.

The Army Corps of Engineers and the Soil Conservation Service are scheduled to issue a flood damage report for each hydrologic subunit during F.Y. 1970. These reports are planned as a part of the River Basin Type I Framework Study. This study will tabulate the expected 100-year damage and the average annual damage to rural, urban, and industrial improvements. The information will be of assistance for planning purposes as it should identify some flood problem areas on desert lands.

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[1] Desert flood conditions in the White Mountains.

[2] Flood Plain Information, Mojave River by U.S. Army Corps of Engineers, 1969.

The below average runoff and sediment yields do not take into consideration the occasionally devastating cloudbursts occurring in the Desert. Certainly without industrial development, intensively developed recreation sites, right-of-way construction, or thickly urbanized areas, present dollar damage to public land improvements would remain minimal over most of the Desert Area. Present measurable damage occurring during these storms is to highways and bridges and railroad tracks. Under conditions of intensive development, catastrophic flows of silt and water would periodically result at many locations.

Ground Water

Any increased use of the Desert automatically creates a demand for water. Many ground water surveys have been made, but since most wells measured are for domestic use only, maximum ground water supplies available cannot be accurately determined at this time. The data logged indicate that domestic water can be reached at an average range of depths of 50 to 250 feet. Wells in large drainage basins and those along major channels commonly are less than 100 feet in depth, with water levels often standing around 50 feet. Those wells in smaller drainages and farther from either active or static drainages are logged up to 1,400 feet in depth. Generally, the relatively few irrigation wells logged produce in the range of 800 to 1,400 gallons per minute. Since precipitation is so low, recharge of underground water is limited.

Total quantity of underground water supplies in the Desert is estimated at approximately 235,000,000 acre-feet.[1] However, this estimate is admittedly a crude calculation owing to lack of substantiating documentation. In any event, the projection is made that once gone, "a thousand lifetimes of desert rainfall will not replace it." The same source shows that increased water use thru pumping results in lowered water tables. For instance, the total overdraft in the Antelope-Mojave region was 160,000 acre feet annually by 1960, with a vertical drop of 4 to 6 feet per year. The"Interim Basin Reports" by the Bureau of Reclamation predict similar overdrafts for other basins of the desert as pumping use increases without adequate recharge. Generally, authorities agree that the major source of underground recharge is seepage from existing streams since the normal amounts of precipitation are sufficient to infiltrate the soil for only a few inches.

Additional studies are needed in the mountainous areas for locating sources of water for wildlife, livestock, and recreationists. It is anticipated that most of these water supplies will be developed from small perched water tables or semi-surfaced springs.

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[1] "Aqueduct Empire" by Erwin Cooper, The Arthur H. Clark Co., Glendale, California, 1968

Studies of phreatophytes growing along or near live streams disclose that additional surface or ground water supplies may be realized by removal of such vegetation. One source estimates the annual consumption of one tamarisk tree at 7 acre-feet of water. Many thousands of such phreatophytes line the Colorado River banks.

Because of the amount of speculation required in predicting underground water supplies, present methods are not completely satisfactory. More intensive study is needed to develop methods that would locate small sources of ground water supplies and more accurately predict rates of recharge and overdrafts in large basins. In the event that eventual import of water is provided to the Desert Area, aggradation of ground water may become problematic.

Ground Surface

The character of the ground water is of basic importance to the land manager. The Quartermaster Research and Development Command's Environmental Protection Research Division has published some excellent information on the California Desert Study area. A small scale map included in the Technical Report EP-53, "A Study of Desert Surface Conditions" (April 1957) shows playas, desert flats, bedrock fields, alluvial fans, sand dunes, badlands, volcanic and desert mountains by geological type (granitic, volcanic, etc.).

Sedimentation

Records of sedimentation accompanying water runoff are available at only one station in the Desert. These records are a portion of the Mojave River study and are not representative of the sedimentation occurring under the more average conditions prevailing on the vast acreage of the more typically desert climate.

The most reliable method of determining sediment yield from the desert watersheds is the PSIAC system presented by the Water Management Committee (October 1968). This system indicates a range of 0.2 to 0.5 of an acre-foot of sediment from each square mile of area annually. As a matter of comparison, 0.2 of an acre-foot equals approximately 323 cubic yards, or 0.0004 of an inch of soil from one square mile annually. This is a very low sediment yield and as expected low rainfall and very porous soils such as exist here result in a low sediment yield class.

The above sedimentation rate is not at all indicative of the massive erosion that occurs during a cloudburst, but rather a pattern of the normal rate of geological erosion.

Available Data

At least six agencies, either federal or state, have made hydrologic studies of all or portions of the Desert Area. They include the Department of Commerce, Department of the Army, Soil Conservation Service, Bureau of Reclamation, Geological Survey, and the California Division of Water Resources. In addition, several universities are studying subjects that relate to hydrology, such as vegetative reproduction and infiltration rates.

Much of the information in this report is available in more detail in existing publications of the agencies mentioned above.

The U. S. Bureau of Reclamation,Region 3, has issued interim reports on the Mojave River Basin, Chuckwalla Valley, Amargosa project (Nevada-California), Indian Wells and Searles Valley, Morongo-Yucca-Upper Coachella Valley, and Borrego Valley, California. The reports include information on ground water basins, existing and potential arable acres, hydrological studies with climatological and hydrological data that appraise the surface and ground water capabilities, geology, and potential for future development.

The U.S. Quartermaster Research and Development Command has published "The Study of Desert Surface Conditions." It classifies the Desert Area into the following types: (1) playas; (2) desert flats; (3) bedrock fields (three categories); (4) regions bordering through-flowing streams; (5) alluvial fans and bajadas; (6) dunes; (7) dry washes; (8) badlands; (9) volcanic cones and fields; and (10) desert mountains.

The U.S Army's Natick Laboratories, Natick, Mass. has issued a report "Sequential Study of Desert Flooding in the White Mountains of California and Nevada." The investigation was a follow-up to a similar study conducted in 1956-57. In the earlier study, it found that three physiographic characteristics influencing flooding behavior in the Desert stream system: (1) Trunk Canyon profiles; (2) amount of debris on floor of trunk canyon; and (3) width of lower canyon and canyon mouth. The report concludes that the most dangerous canyons are steep, narrow, and floored with 5 to 15 feet of unconsolidated debris. The area of greatest flooding danger on a desert alluvial fan is a radial zone extending from the apex toward the margin and flanking and including the active channel. The upper and lower thirds of the fan are classified as moderately dangerous; the middle third is subject to only slight flood danger.

Some of the material presented in this study could be extrapolated and applied to the mountain ranges within the Desert Study Area. It could be used to insure that the safest sites are used in development of campsites and access roads where recreation pressure requires such construction in the narrow canyons.

Precipitation

The U.S. Environmental Science Services Administration has 45 precipitation recording stations at various locations throughout the study area. Climatic data are available for the years 1931 to date. The data are given on a monthly and yearly average basis. Generally, average annual precipitation at lower elevations ranges from 3 to 4 inches; higher elevation recordings in the Desert interior register averages of 8 to 10 inches annually.

The publication "Probability of Selected Precipitation Amount -- T 8 (October 1967), University of Nevada" has information on four desert stations: Barstow, Indio, Brawley, and Blythe. It attempts to predict precipitation patterns on the basis of the patterns occurring during the 30-year period from 1931 to 1960.

The Weather Bureau has released an isohyetal map of the desert area. It is adequate for planning purposes and for project development. The U.S. Geological Survey in cooperation with the BLM Riverside and Bakersfield District Offices has 14 recording rain gauges located in areas on the desert that are not covered by the regular weather stations. This existing additional network should fill in the necessary information gaps needed for management and rehabilitation measures.

Ground Water

The Bureau of Reclamation, and the Geological Survey in cooperation with the California Department of Water Resources has logged nearly all known wells in the Desert and has tabulated them by location, date, owner, year completed, altitude, depth, diameter, yield, chemical analysis, use of water and depth to water below ground level.

The number of wells tabulated to date exceeds 3,500 and provides a good picture of depths to water in all of the valley areas. These data need to be summarized and put in a form that can be usable for BLM planning and development purposes. The inventories are now scattered in many publications.

Watersheds

An inventory is needed to identify and quantify watersheds in relationship to their site productivity and erosion rate. The inventory effort will serve to establish priorities for intensive analysis of watersheds or project areas. The BLM is presently engaged in such an inventory. The watershed rating system, consisting of five phases, has been developed by the BLM as a result of the influence of PPBS (Planning, Programming Budgeting System) and management's need to insure that watershed investments are being made in the higher priority areas to meet Bureau objectives. The initial inventory work will rank watersheds against a common criteria to establish those which should be given priority for intensive analysis. This work is in two steps.

Step 1: Inventory of physical data and establishing a watershed rating based on three primary elements: (1) rate of erosion on productive lands, (2) productivity of the land, and (3) the amount of productive land subject to erosion in the watershed.

Step 2: Consideration of the non-physical factors which influence the need for early treatment of watersheds. Work is needed to (1) curb offsite damage, (2) improve water yield, (3) develop livestock forage, (4) enhance community welfare needs, or (5) solve resource management problems.

Collection of needed basic watershed data and evaluation of the effects different uses have on the desert watersheds will aid the BLM in making better management decisions. Runoff and sedimentation now have little economical effect on uses in the Desert-mainly because of the lack of capitalized improvements. But with the increased demands being made for more services and facilities in the Desert, capitalized improvements must be made. Proper location of development areas, away from flood plains, would save on flood damage to structures. Dollar values that can be saved would be the replacement value of the improvements -- not to mention possible human lives.

With the development of an adequate watershed data base and rating system, the BLM can anticipate and assess the effect of various uses of the desert and take adequate steps to make these uses compatible with protection of the Desert landscape and environment. Identification of the different rates of site productivity loss will, for example, help us concentrate our manpower and funds on those areas that need immediate attention.

Proper location of BLM facilities such as way stations, access roads, and campgrounds would reduce or prevent any loss that could occur from flash floods.

THE VEGETATION RESOURCES

Ninety percent of the soils in the California Desert support some type of vegetation of various species and density. This vegetation, however sparse, helps to stabilize the fragile soils from occasional cloud bursts or frequent strong winds.

The two dominant species found throughout most of the Desert Area are creosote bush (Larrea tridentats) and burr sage (Franseria dumosa). Both are low, slow-growing shrubs 1 to 6 feet tall and are easily damaged by any kind of mechanical disturbance. For purposes of the Desert Study, the vegetation is considered in two broad zones.

VEGETATION ZONES

The larger zone occupies about 75% of the Desert, at elevations below 2,500 feet. The more arid portion, is characterized by broad valley floors of very sparse vegetation and erosion pavement. Vegetation density may not exceed 2 or 3%. As elevation increases density increases. Various annual forbs, such as desert sand-verbena (Abronia villosa), filaree (Erodium cicutarium), buckwheat (Eriogonum spp.), lupine (Lupinus spp.), coreopsis (Coreopsis spp.) and loco (Astragelus spp.) are interspersed with the shrubs. Annual grasses, such as six weeks grama (Bouteloua barbata), 3 awn (Aristida) and red brome (Bromus rubens) along with occasional patches of perennial grasses -- mostly big galleta grass (Hilaria rigida) -- are common. Trees rarely grow here -- they are usually next or adjacent to the stream channels. They include smoke tree (Parosella spinosa), ironwood (Olneya tesota) and palo verde (Cercidium floridium). In a technical sense, this vegetation zone includes the Colorado Desert and lower elevations of the Mojave Desert.

The second and smaller vegetation zone occupies foothills, higher mesas, and mountains, and other land above 2,500 feet elevation. Rainfall is adequate to support a heavier growth of vegetation. Creosote bush and burr sage are common, but the mixture of shrubs is much greater, including such common species as black brush (Coleogyne ramosissima), spiney hop sage (Grayia spinosa), winter fat (Erotra lanata), spiney menodora (Menodora spinescons), thornbushes (Lycium spp.), joint firs (Ephedra spp.), and Yucca (Yucca spp.).

This area supports good stands of perennial grasses, including black grama (*Boutelouaeriopoda*), bush muhly (*Muhlenberra porteria*) and galleta grass (*Hilaria jamseii*). Annual grasses and numerous annual forbs are common. A characteristic of this smaller zone is the extensive stands of joshua trees (*Yucca brevifolia*) that form a woodland overstory over large acreages of the high desert. Sagebrush (*Artemisia tridentata*), and pinion-juniper woodland are comparatively rare and occupy only a small acreage in the upper altitudinal extreme of the Desert.

Botanically this zone includes the Mojave Desert with exception of the lower elevations.

To most people the desert vegetation is uniform, but to the close observer it has many facets; some of the more important aspects that should be set aside for study include shadscale scrub, creosote bush scrub, alkali sink, pinyon-juniper woodland, and Joshua tree woodland. Even this generalized list of vegetation types, as defined by Munz and Keck, does not adequately cover all aspects of the Desert. To this list should be added the California Fan palm oases, Sonoran Desert wash vegetation with its tree development of palo verde, ironwood, and mesquite; alkaline and fresh water springs and permanent streams with their exceedingly local riparian and mesophytic vegetation. Effort should also be made to protect endemic species. According to Munz about one-fourth of the flowering plant species occurring in the Mojave Desert are endemic, that is, do not occur outside the desert borders; these species are further limited within the desert. He lists 49 endemic species for the western or southwestern Mojave, 17 for the western Mojave, 33 for the central Mojave, 17 for the northern Mojave, and 17 for the eastern Mojave. In the Colorado or Sonoran Desert, about one-eighth of the species are endemic, with 33 species listed for the western and southern portions and 15 for the northern. In addition, there are 36 species endemic to both deserts. These lists prepared in 1935 are undoubtedly subject to revision, but they indicate the unique nature of the desert vegetation. Some of these plants are the only representative of widespread tropical plant families, and their ecology at the northern limits of their ranges needs investigation. In addition to the native plants, the Desert now contains numerous introduced species. And the tolerance of these species as well as their interaction with native vegetation needs study.

Preserving, enhancing, and developing esthetic values provided by nature (vegetation) may well be one of our primary needs in the Desert Area. Broad, extensive vegetative maps exist but are not sufficiently detailed for intensive multiple use-planning.

The need for an intensive vegetative survey of the Desert Area is becoming more and more critical as use of the Desert increases. Rare species, such as the crucifixion thorn (Holocantha emoryi), California fan palm (Washington filifera), ironwood (Olneya tesota), smoke tree (Dalea spinosa), desert holly (Atriplex hymenelytra), saguaro cactus (Cereus giganteus), and many other plants -- trees, shrubs, perennials and annuals -- need to be identified as to location, extent, and condition.

Exceptional stands of the various vegetation types should be noted. An example of this would be the creosote bush stand on the western slopes of the Imperial Sand Dunes on either side of California State Highway 78. Towering nearly 10 feet, this particular species apparently reaches its aboreal climax here.

Without a detailed survey, location of rare species will tend to continue as a hit-or-miss effort. This type of approach is neither economical nor practical. An example of a rare plant in California is the saguaro cactus. In only a few places has this cactus crossed the Colorado River, and every effort should be made to protect these specimens. Two locations are known at this time -- 10 miles north of Earp, California, and 4 miles north of Palo Verde Peak.

DAMAGE TO VEGETATIVE COVER

Actual destruction of the vegetative cover is occurring generally over all the Desert. Most areas affected are small, but the degree of damage is accelerating in direct proportion to the many uses being made of the Desert. These uses include off-road vehicles, unregulated livestock grazing, unregulated vegetation harvest (amateur and commercial plant collections), mineral explorations, and denudation caused by unplanned road construction.

Evaluation of off-road vehicle use and its effects on the vegetation and soils should be intensified immediately. Plants can be damaged or destroyed through mechanical destruction of their above-ground vegetative parts.

Less well known is the damage through compaction of the soil around the plants. Soil compaction by people or vehicles around desert plants could injure vegetation. Compaction decreases the water infiltration rate, thereby increasing the already droughty conditions. On the open desert an annual rainfall of 4 to 6 inches distributed over some months may moisten the upper layers of the soil. Therefore, plants like creosote bush, cacti, and goldenbrush tend to have very superficial, wide-spreading roots that can gather in what moisture becomes available. Any compaction around these plants would limit water infiltration and actually increase the drought conditions. Their use in washes, water courses, and basins would be less severe since vegetation that inhabits these areas, such as mesquite, palo verde, and ironwood, send roots down immense distances to tap underground sources of moisture.

Desert vegetation may be subject to damage by pollution. The University of California at Riverside has reported that "there is a potential danger that air pollution may be causing damage to vegetation in the desert."

Until the recent expansion of recreation and other activities in the Desert, livestock grazing has constituted the primary use of the desert vegetation. Grazing has received little or no regulation, with the resulting decrease in vegetation density, and invasion of inferior species. Desirable Perennial shrubs and grasses have been replaced by short-lived ephenerals. Reversal of this trend on ranges where deterioration has taken place and its prevention where the vegetation is still in good condition,requires inventory followed by intensified management. The Bureau's failure to pursue these needs will continue the trend toward inferior vegetative cover. This not only reduces the ability of the range to support livestock, but creates a more unstable livestock operation. The effectiveness of the vegetation in holding the fragile desert soils is reduced. A high proportion of ephemeral forbs will be quite showy with spring wild flowers, but such vegetation is short-lived and of low value for stabilizing soils and watersheds and for livestock grazing.

The Wildlife and Fish Resources

The California Desert is important wildlife habitat for many wildlife species, particularly endemic species. Management of this habitat is mandatory for the perpetuation, and even survival, of wildlife in this area, and for the proper human utilization of the wildlife resource.

Wildlife management consists of both management of the animals themselves, and management of the habitat. The BLM's responsibility is habitat management on the public domain. The California Department of Fish and Game is primarily responsible for the wildlife. In any wildlife management program for the Desert, however, close coordination is essential.

"Wildlife" includes "fish" in the Bureau's program. But for this report the fishery data are covered separately.

WILDLIFE

This part of the Report is concerned with the terrestial wildlife species and their habitat, including the status of herpetological species--amphibians and reptiles. We have emphasized here the status of wildlife and wildlife habitat, uses of this resource, future projections, and the detailed planning needed to manage the resource adequately.

SPECIES

Nearly 200 vertebrate species are found in the Desert. Many are found only in this habitat type. The following are the more important game animals: Inyo mule deer (Odocoileus hemionus inyoensis), Rocky Mountain Mule deer (Odocoileus hemionus hemionus), Burro deer (Odocoileus hemionus eremicus), California mule deer (Odocoileus hemionus Californicus), and southern mule deer (Odocoileus hemionus fuliginatus). Desert bighorn sheep (Ovis canadensis nelsoni), and Peninsular bighorn sheep (Ovis canadensis cremnobates), are present, but are not hunted in California.

Upland game birds include: Gambel quail (Lophortyx gambelii gambelii), California quail (Lophortyx californicus), Pallid Mountain quail (Oreortyx pictus russelli), Desert Mountain quail (O. p. eremophilus), Chukar partridge (Alectoris graeca chukar), white-winged dove (Zenaida asiatica mearnsi), mourning dove (Zenaidura macroura marginella).

Rabbits and hares include: Audubon cottontail (Sylvilagus audubonii) and black-tailed jack rabbit (Lepus Californicus).

Of probably greater importance than the game species are the many non-game species present in the Desert. Non-game animals include the kit fox, coyote, badger, bob-cat, gray fox, spotted skunk, raccoon, muskrat, beaver, several varieties of ground squirrels, chipmunks, wood rats, mice, other rodents; many species of birds, including several species of waterfowl; and various snakes and lizards. The Salton Sea, Colorado River, and, at times, large playa lakes are important areas for waterfowl and other aquatic birds. Nine species of bats have been noted in the Joshua Tree National Monument area.

In the reptile and amphibian category, an endangered species in the higher desert is the black toad (Bufo boreas exsul) in Inyo County. In the lower desert, the desert tortoise (Gopherus agassizi) has been accorded the status of a protected species. The status of the Amargosa toad (Bufo boreas nelsoni) is undetermined. The chuckwalla (Sauromalus ater), the largest lizard in California, gives its name to a number of geographic areas.

The herpetological composition of the lower desert is especially valuable because it holds many peripheral life found primarily in Baja California, Mexico. The peripheral species found in the California Desert include:

Leaf toed Gecko (Phyllodactylus Xanti)

Granite night lizard (Xantusia henshawi)

Granite spiny lizard (Sceloporus orcutti)

Small scaled lizard (Urosaurus microscutatus)

Banded rock lizard (Streptosaurus mearnsi)

Desert rosy boa (Lichanura trivirgata)

Desert Patch-nosed snake (Salvadora hexalepis hexalopis)

California lyre snake (Trimorphodon vandenburghi)

Red diamond rattlesnake (Crotalus ruber)

USES OF RESOURCES

The River Basin Framework Committee of the Bureau of Sports Fisheries & Wildlife has compiled preliminary figures on the uses of wildlife in a publication of the California Regional Framework Study. Its figures include all land within the Desert Study Area. Monetary values are conservative estimates based on recent economic surveys made in several Western States. The percentage of annual visits spent in a wildlife use and amount of money spent that is attributable to BLM land should be nearly proportional to BLM ownership, or about 70 percent. The figures represent most recent inventory and analysis of all uses. This use is in addition to that identified in the Recreation Section of this Report. A "visit", here, means use that varies from a brief period to a full day.

Type of use	Annual visits expended 1965 (No.)	Amount expended annually (Million dollars)
Consumptive (hunting):		
Big game	120,000	2 - 3
Upland game	490,000	2.5 - 7.4
Migratory waterfowl	150,000	0.7 - 2.2
Total	760,000	5.2 - 12.6
Non-Consumptive use:	1,140,000	5.7 - 17.1
Total use	1,900,000	10.9 - 29.7

The present number of consumptive and non-consumptive visits--1.9 million -- will undoubtedly increase at a slightly higher rate than the over-all population. The dollar value of this resource is difficult to project, but it will most certainly increase in at least the same rate as visitor-use. The predicted larger percentage of income available per capita for recreation provides a good reason for suggesting a higher rate. Note that these figures are "visits" and not 12-hour "visitor days". At present,we have no criteria to convert visits to visitor-days.

Consumptive Use

The principal consumptive use of wildlife resources -- hunting -- can be estimated from number of licenses sold. The number sold in California has increased from about 650,000 licenses in 1963 to a projected 800,000 by 1980. But the demand in relation to population increase is expected to drop from about 350 hunters per 10,000 people to 290 on a statewide basis. The California Fish and Game Department has identified the primary cause of this decrease as the space required to pursue and enjoy hunting. Hunting license sales topped 755,000, however, in 1968. Therefore, the figure in 1980 will likely be much higher than originally estimated. Since the Desert provides a relatively large open space, present hunting pressures could well be shifted -- as concentrations occur -- from the central and coastal parts of the State to the southern part.

Another aspect of consumptive use is the growing public interest in herpetology -- as evidenced by the many snake and lizard collectors who roam the Desert.

Non-Consumptive Use

Many wildlife experts believe that non-consumptive uses of desert wildlife resources will become more important than consumptive uses (hunting). Such uses include viewing wildlife, photography, and scientific study and observations. Present estimates show more visits for non-consumptive uses than for consumptive use. A less tangible but significant aspect of wildlife enjoyment is an awareness of the presence of wildlife species.

HABITAT MANAGEMENT

Several agencies and institutions are concerned with wildlife planning and management. The Bureau of Land Management will need to coordinate its work with them in any comprehensive planning effort for the Desert. Considerations for big game are usually written into the Bureau's livestock allotment grazing plans. The Bureau has drafted one habitat management plan (New York Mountains Area) and is developing another (Santa Rosa

Mountains Area). It has installed a few water developments in cooperation with the California Department of Fish and Game. Its Yuma District Office has completed a Lower Colorado River Plan which includes some considerations of wildlife habitat.

The California Department of Fish and Game's fish and wildlife program (1965) includes species plans for all game animals and some non-game species. The plan is projected to 1980. The Department is now updating the plan. It intends to continue cooperative planning and to include more work with BLM on BLM-administered lands. They have constructed numerous water developments in the Desert Area.

The Bureau of Sport Fisheries and Wildlife is coordinating the river basin framework studies and related planning efforts. Regional and sub-regional reports for the area included in the Desert Study, are to be completed in spring 1970.

The University of California is conducting a number of studies of the flora and fauna in the Desert.

PROBLEMS

Increasing Demand

Present trends and projections suggest a slowly decreasing wildlife population and amount of habitat. This decline will, however, not deter an increasing number of people from using the Desert within the next 10 to 15 years. Demand will continue to increase with or without management. Because of increasing restrictions on consumptive and non-consumptive use of wildlife on private lands, the public lands are expected to receive a disproportionately heavier use from increasing human populations. And wildlife values, without planned full management, will decrease at a rapidly accelerating pace. But with proper management, the BLM can probably look forward to entering the year 2000 or even later with a valuable wildlife resource still capable of satisfying, at least in part, the human demands upon it.

Current Losses

Quantitative information is generally lacking, but we have good reason to believe that some wildlife values are being lost. Bighorn sheep, for example, have lost some habitat and their numbers have dropped because of human appropriation of vegetation, water, and space. The rare penisular bighorn sheep is gradually being crowded out of its habitat in the Santa Rosa Mountains.

Deer habitat has probably been lost because of domestic sheep grazing in the northwest part of the Study Area. Other losses of habitat have evidently occurred for the following rare or endangered species: Southern bald eagle, American Peregrine falcon, greater sandhill crane, Yuma clapper rail, and black toad.

Upland game birds may well be losing their habitat in areas where heavy recreation is interfering with life cycle functions, such as nesting and brood raising. Further study is needed to verify this condition.

In some areas snake and lizard collectors may outnumber the species. This form of people pressure has an adverse effect on herpetological habitat. Other uses of the Desert contributing to the damage being done include urban encroachment, intensive recreation use (picnic sites, off-road vehicular activity, recreation homesite construction), road building, and mineral explorations.

Protecting herpetological habitat is considered a special problem. To determine which species should be protected, the Bureau should contact herpetologists at universities and natural museums in the State. The BLM should investigate the establishment of sanctuaries to protect species that have restricted habitat. It should develop an educational program to protect the users of the desert against the potential hazards of poisonous species in the Desert.

Conflicts

Among the many conflicts that exist, several are worth citing. Bighorn sheep are probably not compatible with human use of the same immediate area. Nor are they very compatible with livestock use (domestic or feral). Both situations exist in the Study Area. Deer are not compatible with overuse of forage by livestock nor with complete appropriation of water by humans. Again, both situations exist.

Feral burros cause problems and conflicts with wildlife and wildlife habitat. They have a significant effect on the soil, vegetation, wildlife and other range resources in the area. In a few areas, wild horses may create simular problems.

The compatibility of any wildlife species with the various types of intensive recreation use is not thoroughly understood. But there is enough evidence to suggest the need for research.

Water in the Desert is scarce. Competition for the available supply among wildlife species and between wildlife and human use is apparent in many places throughout the Study Area.

Some species of snakes and amphibians are so restricted in their habitat that they are not compatible with other uses of the Desert.

Limitations

Legislative authority and regulations appear to be adequate for wildlife habitat management planning. But implementation of habitat management is often impeded by inadequate or restrictive legislation and regulations or both.

Manpower and money supply is inadequate to do necessary detailed inventory and planning. The two BLM districts (Bakersfield and Riverside) with land in the Desert Study Area have about 8 man-months each for their entire wildlife program.

PROPOSED WORK

Inventory

The present BLM habitat inventory shows the general locations of major wildlife species in Desert Area. This information constitutes a beginning effort, but is inadequate for planning. We need to complete a detailed Habitat Inventory and Analysis for all wildlife species including reptiles, amphibians and arthropods. Standard BLM procedures (Manual 6600, Habitat Inventory and Analysis) should be followed.

We need (1) detailed inventory of present and potential habitat including habitat segments used for important live history functions, (2) the establishment of Wildlife Habitat Areas for intensive study and management, (3) the determination of relative management needs among Wildlife Habitat Areas and the preparation of management priority recommendations based on the needs, (4) the identification and documentation of habitat and habitat-related problems, (5) the formulation and analysis of management alternatives which will solve the above problems, and (6) the development of management recommendations for use in coordinated resource planning and resultant Habitat Management Plans.

Work on reptiles and amphibians should probably be contracted to an appropriate agency or University.

Planning

Wildlife management recommendations as developed in the Habitat Inventory and Analysis need to be coordinated with other resource management recommendations. Management decisions must be made and habitat management plans developed for each identified wildlife habitat area (BLM Manual 6620, Habitat Management Plans). The Bureau is hampered in accomplishing wildlife habitat management planning by the lack of manpower and basic habitat inventory data.

Cooperation with the California Department of Fish and Game in developing wildlife plans for the Desert is essential. The Department has indicated its willingness to help.

Research

We need research to fill the gaps in our knowledge of basic biology and ecology. Two types of research are needed: the first is primarily a matter of compiling existing research findings and developing detailed descriptions of species life histories and habitat requirementsas they pertain to BLM needs. The second type of research is that concerned with field work: (a) basic research in life histories and habitat requirements, and (b) research in ecological effects of other land uses on pertinent wildlife species and their habitats.

We should also investigate areas of planned recreation development and areas where recreationists are now concentrating. And we need to study non-compatible or conflicting uses in other categories, such as livestock grazing (domestic and feral).

Penalties of Inaction

A major result would be the loss of wildlife habitat and wildlife, because of other uses, through lack of knowledge and lack of action. Thus, a rare or endangered species may become extinct, or loss of habitat for some species may seriously affect their numbers.

The other major result would be loss of opportunities to provide improved wildlife habitat. Therefore, there would be failure to maintain or increase wildlife populations. Such populations are required to help satisfy the increasing recreational demand for wildlife. Reduced wildlife habitat and wildlife would mean recreational opportunities.

FISH

Some fisheries in the California Desert attract some of the heaviest angler use in the State. Others are of interest primarily to ichthyologists (zoologists concerned with fishes) and students of natural history.

The legal responsibility for management of fish in the Desert rests primarily with the California Department of Fish and Game. Its Branch of Inland Fisheries has an experienced scientific staff and a special section that is managing several habitat areas of desert fish. The Bakersfield District of the BLM works closely with the Department staff in Owens Valley.

The California Department of Fish and Game has a small staff managing the various fisheries of the lower Colorado River system. Conservation officers monitor sport fishermen using the canals and ditches leaving the Colorado River projects for irrigated lands. The inland fisheries staff also is engaged in monitoring and management of the extremely popular Salton Sea fishery.

The Western Region of U.S. Bureau of Sport Fisheries and Wildlife works with rare and endangered species of fish and wildlife, and its River Basin Section in Sacramento prepares impact reports on all water development projects built with Federal funds.

The Bureau of Land Management's responsibility for managing the habitat of aquatic and terrestial wildlife should mesh closely then with the activities of state, federal agencies and universities in the effort to manage, protect, and utilize fish populations.

RESTRICTED POPULATIONS

The highly restricted populations of fishes in the Desert are of primary interest to naturalists, ichthyiologists, students, and a growing segment of the general public who have an interest in the unique heritage. The displays at the Death Valley National Monument and the indoor desert fish aquarium at the Desert Museum near Tuscon, Arizona, for example, attract many visitors.

Even though desert species of fish are of little direct economic importance, there is enough interest from the scientific community to protect these rare and endangered populations. The BLM is already committed to protecting the habitat of rare and endangered species of wildlife. It must have an adequate number of wildlife personnel with fisheries background to cooperatively work with various agencies and institutions of learning and science to study, protect, and properly utilize desert fisheries.

The Desert Study Area should be extended to include the desert habitat in Inyo County east of the Inyo and White Mountains. Several spring areas could be importatnt for transplantation of desert fish to establish additional populations.

Desert fish found in restricted habitat include: Amargosa pupfish (Cyprinodon nevadensis), Salt Creek pupfish (Cyprinodon salinus), Owens Valley pupfish (Cyprinodon radiosus), Mohave chub (Gila mohavensis), Speckled dace (Rhinichthys osculus), Mosquitofish (Gambusia affinis), Desert pupfish (Cyprinodon macularis), Owens Valley chub (Gila n. sp.), Owens Valley suckea (Catostomus n. sp.), and Arroyo chub (Gila orcutti).

Eight universities or colleges have shown a definite interest in desert fishes. They include Scripps Institute of Oceanography, University of Michigan, University of Nevada at Las Vegas, Fullerton State College, Arizona State University, University of California at Riverside, University of California at Berkeley, and Utah State University. Some universities, such as University of Nevada at Las Vegas, use the habitat of these fish as field laboratories to train undergraduate and graduate students.

Current Losses

In the last 100 years, the aquatic habitat and the fish faunas of the American southwest have undergone radical changes. Six or seven species have become extinct, at least 13 others have been either locally exterminated or are so endangered that they too may vanish. These 19 or 20 species constitute almost 20 percent of the known aboriginal fishes of western North America. The only remaining pure strain of the Mohave chub, for example, is located in a spring developed at Soda Dry Lake on a resort on BLM land.

Problems

Some of the habitat of these species has been destroyed by diverting water for other purposes and by lack of protection of springs from livestock. Some of these small springs contain warm water that becomes a temptation for people to introduce tropical fish.

The introduction of tropical and other fish not indigenous to the water system has caused serious competition and cross breeding. Some populations have been completely displaced. A major problem is the protection of the remaining populations from collectors themselves. Law enforcement or new laws are needed to protect remaining populations. One problem will be the difficulty of convincing the general public and administrators of the necessity of saving these remnant stocks of desert fishes.

Protection of the present habitat will have the potential of saving some of the remaining population of these rare desert fish. It is possible that, with artificial water development and additional work on spring areas, the present populations of fish could be transferred to suitable habitat. Existing populations could then be doubled or tripled.

Some spring areas containing rare fish are being destroyed by pumping water for irrigation of desert lands.

SALTON SEA AND TRIBUTARIES

Although the 220,000-surface-acre Salton Sea and its tributaries are primarily on non-public lands, their fisheries provide a unique attraction to recreationists. The presence of salt water fish in inland waters is not matched elsewhere in the country, and draws both local and out-of-state anglers. With its fishery resource, water-based recreation, campground, and resort facilities, the Salton Sea area provides a natural location for side trips into the California Desert. Public lands can expect to receive heavy use from this concentration of people if the fishery remains in good condition.

Fish found in the Salton Sea include: threadfin shad (Dorosoma petenense), desert pupfish (Cyprinodon macularius), mosquitofish (Gambusia affinis affinis), striped mullet (Mugil cephalus), sargo (Anisotremus davidsoni), bairdiella (Bairdiella icistius), orangemouth corvina (Cynoscion xanthulus), shortfin corvina (Cynoscion parvipinnis) and longjaw mudsucker (Gillichthys mirabilis).

From 1963 to 1967, the number of angler trips ranged from a high of 377,010 to a low of 296,595. If the value of each trip is considered to be $5.50, the annual direct economic value from fishing use alone would exceed $2 million for the record year of 1965. And this figure does not include the value of more than 1,000,000 fish caught and consumed by anglers . The $5.50 value of an angler trip is used as a conservative figure for the total expenditures of anglers -- not the amount they would pay for the privilege of fishing.

Management

The California Department of Fish and Game actively manages the Salton Sea Fishery. Its research led to the introduction of aquatic animals and fish that have provided an outstanding fishery for Corvina, Sargo, and Bairdiella.

A study now in progress of Salton Sea, includes 17 participating state and federal agencies, five or more advisory agencies, and one private consultant.

Access to angling on Salton Sea is provided by the California Department of Fish and Game and the State Department of Parks and Recreation. Access appears to be adequate, and these agencies should be encouraged to continue the program. To avoid problems over access in the future, isolated tracts of public land next to the sea should be identified and reserved for public recreational use.

Fishing piers have been suggested to accommodate needs of anglers without boats. Piers would also permit fishing in deep water that is not now available to bank anglers because of the shallow shorelines.

Problems

The major problem now is the possible loss of the entire fishery. Recent studies have indicated that some losses can be expected by 1971 if some method is not found to halt the rising salinity of the sea. Adding to the problem of the steady rise in salinity is the problem of increasing nutrients caused by enrichment from domestic pollution and by fertilizers. The highly fertile water encourages heavy growth of alga and red tide organisms. This condition leads to odor problems and fish die-offs. Fish populations will stop reproducing naturally if salinity rises to more than 40 parts per thousand.

Fish also populate the backwaters, sloughs, and hot springs of Salton Sea. Some of these areas hold tropical fish and populations of native fish introduced from the Colorado River; for example, desert pupfish (Cyprinodon macularis). These populations could also be threatened if water quality deteriorates in the Sea.

Channel catfish farming is slowly becoming a recognized industry next to the Salton Sea. Some of the operations depend on deep wells (up to 900 ft.) to provide proper water supplies. New operations now underway use water from canals. Economical operation will depend on whether the water is classified for the lower-cost agricultural or high-fee industrial use.

The impact of this new operation is difficult to determine. If it becomes profitable to use canal water to rear channel catfish, there are many locations along the Coachella and All American Canals, next to public domain, that may be adaptable for future reservoir areas in which to provide a sport channel catfish fishery. The legal status of such application to lands would have to be investigated.

LOWER COLORADO RIVER

The southeastern boundary of the Desert Study Area is the lower Colorado River, with its complex of reservoirs, backwaters, and irrigation diversions. The uses of the 265 miles of river and adjacent lands are coordinated by the Bureau's Lower Colorado River District Office, headquarterd at Yuma, Arizona. At present the Bureau is not involved in the fishery or habitat management of the lower Colorado River. Immediate planning and management of fisheries on the River is a joint responsibility of the Arizona and California Departments of Fish and Game. Coordination of habitat management work between the BLM and State Fish and Game Departments will be necessary in the future.

Current Usages

More than 604,000 angler trips are recorded each year on the California portion of the River. A small population of striped bass has been established in the river. If this fishery should improve, even greater use of the area for angling can be expected. Other water-based recreation, such as water skiing and boating, are major recreation uses, and fishing is growing in popularity. From Needles, California to Yuma, Arizona, at least seven major recreation sites in the California Desert that are within a few miles of the river boundaries have been identified.

Problems

Protection of native fish in the Lower Colorado River is a pressing problem there. The Bureau of Reclamation is drastically changing the fish habitat by channelizing and removing phreatophyte vegetation. These changes have the potential of destroying the quantity and quality of the fish population. State of California fishery biologists are now trying to measure specific effects on the fishery.

Diversion of water to agricultural and other uses in the Lower Colorado River is having a decisive influence on the fishery resources. Some fish species, squawfish, for example, that were once prolific have become increasingly rare as the River becomes a reservoir. In the 1930's fishery biologists reported that ditches from the first Colorado River projects were clogged with native squawfish and suckers. Farmers were able to haul away fish from the area by the wagonloads. But over the years, native fish have declined in numbers owing to changes in the river and blockages to their normal migration. It is doubtful that the BLM, by its work in the Desert Area, can reverse this trend.

IRRIGATION CANAL

The perennial flow into the canals and ditches of the Lower Colorado River permits the propagation of game fish. Popular game species include channel catfish, flathead catfish, and a few largemouth bass. Canals in the populated areas are heavily used, but little use is seen in the public lands portions. The California Department of Fish and Game monitors rather than actually manages the fishery. It estimates that 5,987 miles of canals are available to fishermen.

Fisheries biologists report that the canals hold a substantial fish population. However, little, if any, planning is being done. The irrigation companies do not always encourage fishing, and discourage it in some sites. This untapped potential fishery, with substantial areas of it next to BLM lands, could have a significant impact on future desert use. The drainage streams dumping into the Salton Sea (New and Alamo Rivers) also support a fair catfish fishery, but here too, little management or planning has been done.

Potential

The fishery potential of the canals, suggests that if proper access and recreational facilities were developed, the number of angler trips could be boosted from the present 170,000 each year to an estimated 370,000. The complete potential is not known, but should be examined in any new study.

But if the irrigation companies were to provide a system to keep fish out of the canals, we could expect a potential loss of the entire fishery. And if they prohibit access to fishing in the canal, loss of the fishery is threatened.

Problems

The California Department of Fish and Game and the BLM now lack permission of canal owners to instigate a program of management for the canal fishery. Laws on the use of the water for management purposes (rearing and holding ponds) may have to be developed. The trespass provisions of state law relating to public use of canals and banks will need study. And the use of the canals for fishing may be in direct conflict with agricultural and other uses.

A special problem is the lack of access to portions of the canals running through the dunes and other areas. There are no camping facilities or drinking water within reasonable distance of the canals.

PROPOSAL

Restricted Populations

Before embarking on a plan of habitat and development for any of the desert fishes, it would be desirable to have a conference with key scientists who have been studying the fishes for many years. This symposium should include representatives of the California Department of Fish and Game as well as scientists closely associated with the resources.

The extensive inventory or rare fish has been fairly well completed. An additional inventory is needed by the Bureau to find new habitat or areas where habitat could be developed.

An immediate program should be started to locate or develop another spring area in the Mojave River to transfer the only remaining pure population of the Mohave chub.

The general locations of the remaining populations of small fish are known. The BLM must acquire more information on specific locations and fisheries characteristics so that an emergency protection program can be carried out for these areas on public land.

Salton Sea

Several of the tributaries to Salton Sea should be investigated to see if immediate protection is needed for rare desert fish. Foremost is San Felipe Creek watershed. Most of the stream is on Bureau of Reclamation Land, but some of the upper portions are within the Desert Study boundary.

An inventory of the Salton Sea proper is probably a continuous operation by the California Department of Fish and Game. The BLM should periodically obtain the annual figures from the agency. An inventory should be made on some of the tributaries to the Salton Sea to determine if springs or residual portions of streams are actually on public domain land. A trout fishery now exists in the Canyon areas.

Lower Colorado River

The Lower Colorado River complex and adjacent desert lands are now prime recreation areas, and permanent residents and itinerant users are increasing. The attraction of the fishery resource has a major bearing on the amount of recreation use and should be managed properly; the BLM must play a role in that management.

Now that the Bureau is the controlling agency of the Lower Colorado River complex, it should immediately determine the impact of the channel changes and phreatophyte vegetation removal on the aquatic habitat.

The inventory of fishery access needs is well documented by the Lower Colorado River Land Office, California Fish and Game, and Arizona Fish and Game Department are actively managing the fishery. Enough data can be obtained to determine the impact on desert lands by working directly with personnel of the BLM's California State Office River Basin Section and with Bureau of Sport Fisheries and Wildlife personnel in Sacramento, California.

There is a need to evaluate the habitat impacts on the fishery and to coordinate technical fishery information obtained from ongoing projects on the Lower Colorado River. Most important would be data on angling pressure and catch, and future predictions of angler use.

There is a need to inventory users of the desert in this area so that the impact of the Colorado River recreation area on the adjacent public lands can be determined.

Irrigation Canals and Miscellaneous

Needed is comprehensive inventory of the available fisheries in the canals, the location of the best fishery potential, and the importance of the public lands to these. Inventory of fringe waters in the mountain areas along the west border of the study area also will be needed. And there is a need for a maintenance inventory.

THE SCIENTIFIC, CULTURAL, EDUCATIONAL RESOURCES

Locked somewhere in the once remote vastness of its mountain ranges, plains and dry lake basins, the California Desert holds secrets of man's past perhaps even keys to his future.

Unfortunately the pressures of too many people on the Desert today are eradicating many of these clues about our yesterdays and tomorrows before they can be discovered, understood, or appreciated. These values can be grouped into three major categories:

. Scientific, which includes archaeological, paleontological and ecological values.

. Cultural, which includes ethnographic and historical values.

. Educational, which includes the use of the Desert as a classroom and an outdoor laboratory.

SCIENTIFIC RESOURCES

ARCHAEOLOGY AND PALEONTOLOGY

> The following reports on the archaeological and paleontological values in the California Desert were prepared by Roger DeSautels, Archaeologist contracted by the Bureau of Land Management.

The key to many unsolved problems in anthropology, archaeology, and paleontology lies in the vast desert regions now being considered for development by the BLM. Studies there in man's primitive culture and of fossil animals and plants may yield many of the long-sought answers. For this area is a priceless source of historical and scientific data.

Relics once destroyed, can never be replaced. There are, for instance, hundreds of sites that bear only surface remains. In 90 percent of the cases, the archaeological deposits lack depth and therefore have no protection from relic hunters, mining, road building, and the countless other activities now taking place or planned for the future. Scientific study of such open sites is just as important as that of deep middens (refuse heaps) rock shelters, and similar hidden situations where temporary protection has been afforded.

Some work has been done by universities, museums, and private individuals, but it has been so restricted by lack of funds and time that the Desert regions have only been scratched in terms of adequate research. Most work to date has been done by U.S. National Park Service in areas such as Death Valley, Joshua Tree National Monument and the Anzo-Borrego Desert. Work on BLM lands has been done only by private individuals or institutions who have a particular research problem and organize help on a volunteer or class basis.

Archaeology

The archaeological status of the California Desert is particularly critical. Some highly valuable archaeological sites, as well as whole areas have already been damaged or destroyed. This destruction has come about as a result of such activities as roadbuilding, mining and urban development. Most tragic, however, has been the destruction of archaeological remains from the pressure of people flocking to the desert in pursuit of leisure-time activities. In many instances, "people pressure" has resulted in the illegal removal and defacement of archaeological evidence. Motorcycle racing, uncontrolled camping, dune buggy racing, hobbyists collecting rocks and minerals, mining prospectors, and hunters are all, at an ever-increasing rate, destroying these valuable sources of scientific study of our past.

Probably the most important single factor has been the activity of the pot hunter or relic collector. These are people who illegally remove, collect, and deface archaeological materials. Some, are local residents. The majority are people who will and have traveled hundreds of miles to gather arrowheads and pots for removal to their private homes. Removal of these items is illegal. Federal and State laws have been enacted to protect antiquities, but to date, no really effective enforcement program has been implemented.

The Bureau should assume the leadership and responsibility in the preservation of our archaeological heritage in its development of the desert. The authority to perform these duties is clearly stated in the BLM Manual, Section 6231.03, titled "Management of Antiquities". Section 6231.04 clearly defines the responsibility and also states: "Lands containing antiquities will be managed so that full public benefits will be realized". Section 6231.04, titled "Inventory", states in part: " A thorough, continuing inventory will be made of archaeological, historical, and paleontological sites located on lands administered by the Bureau". To date, there has been no coordinated antiquities management plan for BLM-administered lands in the desert.

We realize that the demands upon the BLM for other uses in the Desert Area and a planned "multiple-use" concept must sometimes necessarily go into, and disturb, archaeological remains. When such areas must be so utilized, however, they should be surveyed well in advance of development so that archaeological materials can be gathered and recorded by professional archaeologists.

The lack of existing archaeological data on BLM lands is a significant problem. About 90 percent of the Desert Area has never been systematically surveyed by competent archaeologists. Therefore, thousands of sites exist which have never been recorded. Present BLM policy provides for the recording of archaeological sites if they are found by Bureau personnel in the field, but no effective use has been made of this system. Forms are provided to each BLM District Office for use in recording sites, but to date, only an insignificant number of forms have been filled out and turned in.

Archaeological reconnaissance, however, cannot be expected of the normal BLM employee. Most archaeological sites can be completely missed by an untrained employee. Unless some very striking features remained, such as petroglyphs, whole pots and arrowheads, most sites would remain completely obscure and never be noticed by an untrained eye. Important sites to the archaeologist are not necessarily the late sites with such obvious remains. The recognition of early man sites generally requires the trained eye of a professional.

Paleontology

The paleontology of the Desert Area is commensurate in importance with the archaeological remains. Some of the most important deposits in America exist in the California Desert. All Federal and State Antiquities Laws, as well as the National Park Service and BLM regulations, require that these deposits be protected.

The Desert has been of prime paleontological interest ever since the 1920's when J.C. Merriam, of the University of California, Berkeley, began reporting on fossil mammals from deposits in the "Mud Hills" northeast of Barstow. Other members of the University faculty, including those at Riverside, have maintained a strong interest in the paleontology of the desert. M.O. Woodburne of the Department of Geological Sciences, at Riverside, is probably the individual now most directly concerned with this area. Others include R.H. Tedford, formerly of U.C. at Riverside, now of the American Museum of Natural History, New York; and G.E. Lewis, U.S. Geological Survey, Denver, Colorado.

The deposits near Barstow (Barstow Formation) are probably some of the most important in North America. The fossil vertebrates they contain provide the basis for the Barstovian North American Land Mammal Age, the fundamental late Miocene unit of non-marine faunel correlation in this continent. Other areas in the Desert demonstrate that localities of paleontological interest are widespread in this region. These range in time from early Miocene to Pleistocene and provide crucial evidence as to the historicl mammalian evolution, paleoecology, and paleoclimatology of the region. Two of these localities, Dagget and South Cady Mountains, suggest that the Mojave is still in a pioneering stage of development relative to fossil mammals. These sites are of middle and early Miocene age, respectively, and were discovered in the mid-1960's. Before their discovery, faunas older than late Miocene (Barstow equivalent) were almost unknown in the Mojave. This finding has lead some students to the unwarranted generalization that pre-late Miocene sediments did not exist on the Mojave.

Major Findings

During the course of our initial archaeological and paleontological research in the Desert, we assembled as many records as time permitted on important sites, and evaluated the problem in four priority areas.

Archaeological Sites

Many sites records are on file at various institutions and museums. The following list of the sources and the number of records of sites acquired from each.

UCLA - Archaeological Survey Office	174
BLM - Riverside District	10
San Diego Museum of Man	353
San Bernardino County Museum	137
University of California, Riverside	0
Pacific Coast Archaeological Society	5
Bowers Museum - Santa Ana	5
University of California, Berkeley	300
Personal Communication	25
Survey in the field	39
Total	1,048

We collected site records for the 19 recreation areas listed in the 1968 California Desert Study.

Calico: A heavily used "people pressure" area close to dense population centers. As expected, we found many examples of destruction and vandalism. Petroglyphs at Inscription Canyon, for instance, had been defaced and even some pieces removed. Whole portions of basic basalt had been chiseled and knocked away from their matrix and removed. Elsewhere, desert roads lead directly to and through archaeological deposits.

Paleontological deposits are being removed at and around Rainbow Canyon. Murphy's Well, Black Canyon, Joshua View, Coyote Lake (dry), and Tin Can Alley (appropriately named) showed disturbances. The famous "Early Man" dig near Calico will be within a few miles of one of the BLM's proposed campsites.

Eastern Mojave: Typical "High Desert" area. We camped at "Hole in the Wall" and surveyed the immediate area and country to the south and east. The hole in the wall is a glaring example of sites already destroyed. Two rock shelters and accompanying midden (refuse heaps) have been totally vandalized, with only a few scattered metate fragments and an occasional sherd (piece of broken earthenware) left to indicate that this was once an archaeological site.

In this area we also discovered vandalism to petroglyphs. The accompanying warning signs had been shot up to such a degree that the Federal law prohibiting their disturbance could no longer be read. One large site in this area with possible midden depth was cut through by an existing desert road. Two rockshelters revealed pot hunter activity along with the usual beer cans and debris.

Imperial Sand Hills: This is a typical "Low Desert" region highlighted by one of the largest stretches of sand dunes in the world. Besides the obvious "dune buggy" activity, we observed evidence of sites being destroyed by camping and mining activities. We found a series of sites on a low sand and gravel ridge which extends about 30 miles from Mammoth Wash in the north to the Mexican Border in the south. The sites are all being systematically destroyed by gravel mining up and down the East Highline Canal. These sites are very important to our understanding of the archaeological picture in the southeastern portion of the State. Malcolm Rogers mentions two of these sites in his reports some 30 years ago. These appear to be primarily surface sites and should be recorded and collected immediately before they are all lost to the bulldozer.

Yuha Desert: An important archaeological area near the dense population areas around San Diego, it is well known and favorite spot for pot hunters. During the survey a large site was discovered at Yuha Well where the Phase I California Desert Study proposes a large recreation and campsite area. In this area also are examples of the rare intaglios created by the former Indian inhabitants. One set of these intaglios is presently "protected" by posts and a metal cable which is meant to keep out vehicles. Intaglios, besides being rare, are one of the most fragile archaeological features known and should have more adequate protection. Some unthinking citizens visiting the spot could walk out on the area and totally destroy the figures with several well-aimed boot trails. It is also tempting for vandals to "add their own impressions" to the area as is evident with petroglyphs.

Paleontological Sites

We also investigated but did not intensively analyze paleontological areas that need additional study. Approximately 400 sections in 44 townships in the California Desert are areas known to contain fossil deposits.

Critical Development

Certain areas of BLM land are at this very moment being consumed, by the building of roads and campsites, the leasing of land for grazing and mining, and the unrestricted, uncontrolled use of federal lands for recreation and mining exploration and production. As a consequence, archaeological resources are being destroyed. These areas should be attended to immediately with whatever means are available on an emergency basis:

> All petroglyph and pictograph sites that are available to the public by maintained access (dirt) roads, especially those indicated on existing travel maps, USGS maps,etc. Inscription Canyon (Calico), Black Canyon (Calico),Corn Springs (Chuckwalla), and Grass Canyon (Eastern Mojave) are excellent examples. All campsites and roads that are being constructed or are proposed for construction in the near future and the areas surrounding them. Corn Springs petroglyphs, for instance, should be immediately recorded and photographed before further vandalism occurs. The area immediately surrounding the campground should be surveyed for archaeological sites before a campsite attracts hundreds of more people to the Canyon. A minimum of at least 1 mile in every direction from the site should be covered to insure identification and recordation. Some campers will ride further than this radius, but most of the damage will be done within this area. The areas around Wylie Well and Coon Hollow (Chuckwalla), where campsites and recreation areas are being constructed, should be surveyed at once. The area of Wildhorse Canyon in Eastern Mojave where a new road is planned should be looked at immediately. The existing jeep trail (the approximate route of the new road) already cuts through a known recorded archaeological site (UCLA-AS #366). Further road work will destroy some of the midden and the added traffic over this 11 miles afforded by the new road will further endanger six archaeological sites in the entire area. This site should be tested and the whole Canyon surveyed immediately. The access road planned in the Tufa Pinnacles area is another that should be surveyed soon.
>
> All areas around existing campsites and heavily used areas. Hole in the Wall (Eastern Mojave), Owl Canyon (Calico), Rainbow Canyon (Calico), Mammoth Wash (Imperial Sand Hills), and Tin Can Alley (Calico) being specific examples.

All archaeological areas being destroyed. The sites exist along the western side of Imperial Sand Hill near the East Highline Canal. These sites are being obliterated by gravel mining activity. Bulldozers are moving the sand and gravel hills which contain the raw materials for the gravel industry. Many sites are endangered and some have already been totally destroyed.

Immediate and more adequate protection for the fragile Yuha Desert Intaglios and any others in similar circumstances. Parts of the intaglios have been destroyed by the tracks.

Archaeological reconnaissance should generally be conducted well ahead of planned activities. The occasion may arise where an archaeological site, endangered by development, would be important enough to cause the changing of plans so that it may be preserved. Surveys performed well in advance could result in the saving of considerable money in the planning and designing stages of other activities.

Priority Development

Priority development encompasses activities that should be started as soon as possible. These projects cannot wait for planning to be completed. The most important ones are:

- A systematic and continuing survey of the 19 recreation areas listed in the 1968 California Desert Study. It should be started as soon as possible and should be part of the next 5-year accomplishments.

- Completion of the accumulation of information on known sites. These records should be standardized so that they are all uniform. The records should be expanded to include all BLM lands in the Desert Study Area, and should be kept current.

- In those areas of known or suspected archaeological deposits, contract activities, such as road building, should be included in provisions that allow the BLM to conduct an archaeological investigation during the life of the contract. All areas should be checked in the planning stage before specific project contracts are awarded and access routes are constructed. The costs of archaeological survey testing, and salvage should be considered a part of the construction costs for the project.

- All areas now in the planning stage should be surveyed.

- Liaison with other activities in the Desert should be maintained with special attention given to the mining industry. There is no provision now for protecting sites which could be destroyed by mining activities, exploratory activities, and exploratory access roads that continuously are bulldozed without regard for archaeological remains. At least in those areas where the BLM intends to dispose of salable and leaseable minerals,mining should not proceed without the BLM knowing whether archaeological resources are in jeopardy; and, if so, without taking proper steps for either inventory and record the resources or protecting the resources from encroachment.

- Liaison with Federal, State, and County road departments should be developed. Certain roads can be constructed on BLM land without notice to BLM and are a constant threat to archaeological resources. BLM should also perform the necessary archaeological investigation before construction of any road, bridge, canal, pipeline, transmission line, and dam on public lands in the desert.

- Some important archaeological sites and areas should be set aside permanently for future scientific study. Archaeological techniques of excavation and dating, unknown to us today, will be developed in the future and these reserved sites or areas would be very important.

- A public relations and educational program is needed to make the public aware of archaeological resources and their values. Building respect for irreplaceable archaeological remains can become a great deterrent in the prevention of vandalism and destruction.

> The State Office of the Bureau of Land Management should establish an archaeologist position as soon as possible. This individual would participate in the entire planning and development program as well as accomplish the public relations and interpretive work.
>
> As more and more recreational development occurs on BLM lands, additional people would be required for protective and recreational purposes.

Continuing Development

The Bureau is charged with the following responsibility: "A thorough, continuing inventory will be made of archaeological, historical, and paleontological sites located on lands administered by the Bureau" (BLM Manual Section 6231.1 Management of Antiquities.) Plans for the eventual archaeological survey of all BLM lands should be formulated. But this work should only be done after work on the 19 recreation areas has been completed.

In planning roads and campsites, we should not lead the public directly to archaeological sites. Inscription Canyon in the Calico area is an excellent example. The present county road leading to the petroglyph site takes the visitor directly to the center of the site. The public may drive within a few feet of the petroglyphs. Trash barrels are provided--saying in essence, "Stop here and picnic." Visitors have inscribed their own initials and choice remarks, sometimes directly over and obliterating the originals. Some sections of rock have been actually removed. The area is not adequately posted with antiquities signs.

A partial solution to protection would be to have the access road and "picnic area" lead to a spot somewhere away from the site itself. Just a short 1/4 mile south of the petroglyphs themselves is an excellent picnic spot which would require the public to walk a short distance to view the petroglyphs. A path or indicated path, well posted with antiquities signs, should be developed.

To relieve some of the pressure exerted by pot hunters, certain sites in the Desert Area could be opened to the public for digging.

Archaeologists rarely find it necessary to excavate 100 percent of any given midden to gain an adequate sample of the remains. Some selected sites could be reserved, after scientific excavation, for amateur groups and clubs, and school classes, who would be allowed to dig in specific places. Some degree of professional supervision would be required. Only recognized and qualified archaeologists should be allowed to excavate and only after approval from the Bureau of Land Management.

Benefits

The benefits to be derived from a sound scientific study program for the desert is the preservation of irreplaceable resources such as archaeological and paleontological materials which can be viewed and studied by thousands of scientists, educators, and students in the future. Preservation here is defined as the identification, recording for posterity, and in some instances, setting aside from encroachment those sites and areas that have value for archaeological, paleontological, ecological and resource study purposes. Such value cannot always be quantified, but must be recognized if man is to further his knowledge of historical and ecological successions, and his knowledge of natural resources, i.e., how he affects natural resources and how they in turn affect him.

The following report was prepared for the Bureau of Land Management by Dr. Mildred Mathias, Department of Botanical Sciences, University of California, Los Angeles

The California Desert provides areas which are unique for educational purposes and particularly useful for college teaching. The proximity of the desert lands to many colleges has made them an important resource as an outdoor laboratory which, until recent years has not needed protection. However, with the increasing use of the desert, there is an immediate and imperative need for designation and complete control of adequate areas for teaching and research. Educational needs are not excessive and form only a small part of the total acreage undeveloped lands. Areas selected as scientific reserves must be large enough to be maintained in as natural a state as possible where changes which take place are not the result of encroachment by man and large enough so that long range studies may be significant. For example, a canyon or wash area should include the total drainage system; a mountainous are should include all exposures and an entire, easily definable mountain range would be an ideal reserve; a valley should include control of the entering stream as well as the outlet or the area of the closed basin. Areas designated to protect endangered species or plant communities might be much smaller as long as they were adequately buffered to protect the environment.

Since the vegetation is often the best way to define distinct areas, a system of reserves based on vegetation types would result in in giving us representative samples of the desert environment which could be protected and on which long-range research and class projects could be performed. Although to most people the desert is uniform, to the close observer it has many facets and samples of each desert aspect should be set aside for study purposes: sagebrush scrub, shadscale scrub, creosote bush scrub, alkali sink, pinyon-juniper woodland, and Joshua tree woodland. Even this generalized list of vegetation types, as defined by Munz and Keck, is not adequate to cover all aspects of the desert. To this should be added the Washingtonia palm oases, Sonoran Desert wash vegetation with the fine development of palo verde, ironwood, mesquite, etc., alkaline and fresh water springs and permanent streams with their exceedingly local riparian and mesophytic vegetation. Effort should also be made to protect endemic species. According to Munz about one-fourth of the flowering plant species occurring in the Mojave Desert are endemic; that is, they do not occur outside the desert borders; these are further limited within the desert, and he lists 49 endemic species for the western or southwestern Mojave, 17 for the western Mojave, 33 for the central Mojave, 17 for the northern Mojave, and 17 for the eastern Mojave. In the Colorado or Sonoran Desert, about one-eighth of the species are endemic--with 33 species listed for the western and southern portions and 15 for the northern. In addition to these, there are 36 species which are endemic to both deserts. These lists, prepared in 1935, are undoubtedly subject to revision, but they are indicative of the unique nature of the desert vegetation. Some of these rare plants are our only representatives of widespread tropical plant families, and their ecology at the northern limits of their ranges needs investigation. In addition to the native plants, the desert area now contains numerous introduced species. And the tolerance of these species as well as their interaction with the native vegetation is another topic needing study.

The known distributions of the several endemic species and the general outlines of the vegetation types should be mapped on a large-scale projection. This, then, would form a basis for designation of educational or scientific reserves which would meet the several requirements; that is, preserving vegetation types and endemic species while at the same time providing geographically coherent areas large enough to be functional units. Reservations based on vegetation will, of course, include in them the associated animals. And since the vegetation is conditioned by the substrate on which it grows, geological and hydrological features will also be preserved. Archeological sites, likewise, often will be included since these sites are frequently associated with certain vegetation types.

The desert laboratory has been used by generations of college and high school students. Desert vegetation is usually simple enough to provide a training ground for the student being exposed to the several methods of vegetation mapping. The first studies of plant produced inhibitors were initiated on desert vegetation; germination responses to rain and the seasonality of the rain were investigated in the California Desert; the specificity of pollinators and the coevolution of certain flower types and species-specific pollinators has been investigated in desert species; the rare, endemic fish of isolated waters in the Mojave Desert has provided a fine example of evolution; on adjacent areas of light and dark sands there has been selection for protective coloration in substrate adapted species, another example of evolution which has been investigated in deserts; desert birds, mammals, and insects have developed many unique structural and physiological adaptations to cope with the stresses of high temperature and low water availability; the sparse vegetation cover of the desert offers the geologist unusual opportunities and permits rapid identification of potential fossil beds; the stability of the desert environment has resulted in archaeological sites being unusually well preserved. Long-range studies of population dynamics can be particularly informative in our understanding of the fluctuations in response to climatic conditions; one such study, initiated near Pear Blossom in the western Mojave Desert in 1944, continued for 24 years until the area was destroyed by construction.

A selection of educational and scientific reserves set aside for study purposes would provide generations of students with unparalleled opportunities to investigate the environment in its natural state, and from these studies would come a baseline for the evaluation of the changes wrought in other parts of the desert by man and animals, as well as a base on which to plan for optimum use of the desert areas which are to be developed. Because of essentially unplanned development which has already taken place in the desert, it is urgent that the suggested mapping of vegetation be initiated immediately and that an advisory committee of scientists representing the several disciplines be appointed to work closely with the staff of the BLM in tentative designation of reserves to be used for teaching and research purposes.

The reserves should have a centralized administration through which all use could be scheduled. Within one reserve a number of classes or projects could be accommodated as long as use of the area was cleared through one administrative agency or a local reserve manager. Only in this way could conflicting uses be avoided. A long-range research project should not be destroyed by unknowing invasion of the areaby a class.

The following two reports on Ethnography and on History were prepared by the Western Regional Office, U.S. National Park and are reprinted from the earlier report The California Desert.

ETHNOGRAPHY

The scientific and humanistic understanding of the Indian cultures will be of value to all Americans of the future. The understanding of how man's social and cultural responses to change have made it possible for him to adjust, or fail to adjust, will aid him in making decisions that will unite rather than divide mankind along biological and cultural lines.

In other words, one of the main interpretive values of this kind of information is that it tends to emphasize the unity of human responses to life rather than the diversity which tends to fracture cultural cooperation and growth.

The Indians that inhabited southern California were either of the Shoshonean or Yuman linguistic stock.

Shoshonean

The Shoshonean area in California was a small fraction of the territory occupied by the entire linguistic stock. The Shoshonean had four linguistic branches--Plateau, Kern River, Southern California, and Pueblo. All except the Pueblo were represented in California. Within the Plateau branch, the Shoshoni-Comanche and Ute-Chemehuevi linguistic divisions were represented in the study area. The Tubatulabal, the only group in the Kern River branch lived adjacent to the study area. The Southern California branch was represented by the Serrano and Luiseno-Cahuilla linguistic divisions in the study area.

The California Shoshonean languages were so specialized that a conservative estimate of their antiquity in California would indicate that they were here for at least 2000 years before the time of Eruopean contact (mid 1500's). Indian groups associated with these linguistic divisions that lived in or adjacent to the study area are as follows:

The Koso (Panamint)

The Koso Indians are the most westward segment of the Shoshoni-Comanche linguistic division.

Their territory was large and thinly populated. Exact boundaries are not known, however, the crest of the Sierra to the west has been assumed as the boundary between the Koso and the Tubatulabal, their western neighbors. On the north were the Eastern Mono of Owens River. The other borders indicated on Map 2 are approximate and undoubtedly very permeable. Aboriginally, the Koso were known to have inhabited the Coso, Argus, Panamint, and Funeral Mountains and the intervening Coso, Panamint, and Death Valleys. At the turn of the century they actually lived at four spots in this area--Cottonwood Creek, in the northwest arm of Death Valley; south of Bennett Mills on the eastern side of the Panamint Mountains; near Hot Springs, at the mouth of Hall Creek into Panamint Valley; and northwest from these locations, on the west side of Saline Valley, near Hunter Creek at the foot of the Inyo Mountains.

In 1891, less than 100 Koso were living and by 1923 the Koso were not sufficiently differentiated from adjoining groups to estimate their number.

The Chemehuevi

The Chemehuevi and the following Kawaiisu were of the Ute-Chemehuevi linguistic division. They and the non-California based southern or true Paiute and Ute all spoke dialects of remarkable uniformity and most experts believe that the bands of Chemehuevi were nothing but Southern Paiutes. "Chemehuevi" is the generic name for Southern Paiute and is a Mojave word. The term has remained merely to distinguish the Southern Paiutes of Nevada from those in California.

The Chemehuevi are one of the few California groups to have partly altered their location in the historic period without pressure from the white man. About 1776, the Yuma and Mojave pushed the Halchidhoma (and Kohuans) eastward and the Chemehuevi allied themselves with the victors. Thus, when the Americans came, they found Chemehuevi on Cottonwood Island (Colorado River), as well as in the valley that bears their name, and on both sides of the Colorado River. The movement of Chemehuevi bands as a consequence of Yuman speaking peoples' warfaring greatly influenced their dispersion in historic times. After 1867, a band of Chemehuevi was found as far away as Twentynine Palms. The following villages were recorded for the Chemehuevi in the early 1900's:

Village	Location
Mokwats	Kingston Mountains
Yagats	Armagosa
Hokwaits	Ivanpah Valley
Timpashauwagtsits	Providence Mountains
Moviats	Cottonwood Island
Shivaiach	Chemehuevi Valley

Other villages were located farther west and south but their names and locations were never recorded.

Even though the Chemehuevi area is the largest in California occupied by a people of uniform dialect, their population probably never exceeded 1000 persons and probably less than 260 existed in the early 1900's.

The Kawaiisu

The Kawaiisu were an offshoot of the Chemehuevi and settled in the Tehachapi Mountains. Due to this radical change in environment, the Kawaiisu became much more similar to the western people than their nearest language-kin to the east.

The Kawaiisu inhabited the Tehachapi Pass, Walker Basin, and possibly, some of the effluents of the Kern River. Their ownership on the eastward, drier slopes of the Tehachapi Mountains and the desert area is conjectural.

The aboriginal population may have been 500.

The Tubatulabal

The Tubatulabal were of a distinct Shoshonean linguistic branch. They lived in the upper drainages of the Kern River--adjacent to the western limits of the study area. Their environment, too, partly accounts for this distinction from their neighbors, the Koso and Kawaiisu Indians. The aboriginal population may have been 1000.

The Vanyume

The Serrano linguistic division was represented by the Vanyume and Sérrano (proper) Indians in the study area.

The Vanyume are the Serrano of the Mojave River. Except for a few individuals merged among other groups, the Vanyume are extinct. The limits of their territory are vaguely known.

The Serrano Proper ("Mountaineers")

The Serranos' aboriginal range extended along the San Bernardino Range and an unknown area extending northward. In the east, it was desert; to the west, it was a region of timbered valleys between rugged mountains. They also occupied the San Bernardino Valley close to Riverside.

Their aboriginal population must have been about 1500. In the census of 1910, there were a little over a hundred. Later statistics seem to have completely lumped the Serrano with the Cahuilla, as the former are not mentioned. Thus, they may be extinct.

The Luiseno

The Luiseno and the following Cahuillas were of the Luiseno-Cahuilla linguistic division. The Luiseno, named after the Mission San Luis Rey de Francia, occupied a somewhat irregular territory that extends south from Mount Jan Jacinto--adjacent to the study area. To the north they had the Serrano as neighbors; to the east Cahuilla, and to the south the alien (Yuman speaking) Diegueno.

The Luiseno were a hill rather than a mountain people and seldom reached the summit of the watershed.

Linguistically, there are slight dialectic differences within the Luiseno range, especially between the extreme north and south, but on the whole the speech is remarkably uniform for so considerable an area.

Pass Cahuilla

Palm Springs Canyon was the focal point of this group, and their boundary runs northward or northeastward from Mount San Jacinto. White Water probably marked their limit against the Serrano.

Pass Cahuilla clans, however, seemed to have lived in comparative isolation and not in villages composed of several clans, as did the Desert Cahuilla.

By 1920, the remnants of the Pass Cahuilla people lived on the Moronga Indian reservation near Banning.

Desert Cahuilla

Southeastward from the territory of the Pass Cahuilla, partly below sea level, lies the territory of the Desert Cahuilla. The southern end of this arid valley, occasionally watered by overflow from the Colorado River, was in the possession of the Yuman speaking Kamia. The northern end, down to about Salton Sea, was inhabited by the Desert Cahuilla.

The Desert Cahuilla probably moved from the more hospitable mountainous region although groups may have been scattered along the edge of the desert and west into the Santa Rosa and San Jacinto Mountains as well as the eastern edge of the desert at the base of the Little San Bernardino Mountains. It is also possible that the movement to mountain edges was caused by the occasional flooding of the desert by the Colorado River and when the flood receded, they would return to the desert areas.

There were 16 Desert Cahuilla villages prior to the settlement of Mormons in San Bernardino around 1851.

Mountain Cahuilla

These people lived in the watered canyons south of San Jacinto Peak overlooking the inland desert. Their range above sea level was between 3000 and 4000 feet. Two main groupings were located at Los Coyotes in Coyote Canyon (Santa Rosa Mountains) and the other at Santa Rosa in what is called the Cahuilla Indian Reservation. Old Santa Rosa, located at a fork of Rock House Canyon, was important as a town in about 1875. The ten known clans of the Mountain Cahuilla were influenced by the Spanish mission system to the west, whereas the Cahuilla neighbors to the north and east were relatively untouched. Aboriginal Mountain Cahuilla culture was one of the first to change, making it difficult to study their native way of life.

Yuman

The Yuman linguistic stock of the Hokan language family is represented by the following divisions: the Lower California, the Central, and the Arizona Plateau. The southern California Yuman speakers considered in this report all fall within the Central division, centering on the Lower Colorado River and including the Diegueno (Southern and Northern), the Kamia, the Yuma, the Halchidhoma (and Kohuana), and the Mojave. Although these groups are represented within California, culturally they are more closely associated with non-California Indians in Mexico and Arizona.

The Diegueno (Southern and Northern)

Diegueno territory was bordered on the west by the Pacific Ocean and by the holdings of the Luiseno, Cupeno, and Cahuilla on the north. For the east and south no precise boundary can be set. Although different dialects were spoken between the Northern and Southern Diegueno, there is little known about how culturally separate they really were. The southern territory included such place names as Campo, La Posta, Manzanita, Guyapipe, and La Laguna. Evidence suggests that the Southern Diegueno were primarily located in Mexico. Their southern range is unknown.

The Diegueno population, with Kamia of American California included, may have reached 3000 in prehistoric times; however, in the 1920's this population numbered between 700 and 800. The Diegueno Indians had a higher rate of survival than any other mission influenced group in California. This was in part due to the Mission San Diego's restricted range of influence and to the aggressive nature of the Dieguenos.

The Kamia

As stated in Kroeber's monumental work on the California Indians (1929; revised 1955), it is unknown what group owned the desert to the east of the Diegueno, from Salton Sea to the now fertile Imperial Valley. This area has been tentatively assigned to the Kamia. However, the definition of "Kamia" is questionable as is indicated by Kroeber's statement that the "...southern Diegueno sometimes call themselves Kamiai or Kamiyahi, which once more intrudes the vexing question of who the Kamia were."

The Yuma

The Yuma Indians were the most numerous of the Yuman stock in California and were contacted in 1540 by Spaniards exploring northward from Mexico.

Their territory was centered about the mouth of the Gila River. They are reported to have occupied the main stream for 15 miles above and 60 miles below the confluence of the Gila and the Colorado Rivers.

In former times the tribe consisted of three local divisions, an eastern, a northern, and a southern. Each division is said to have spoken a slightly different dialect, although at present Yuman is the single, undifferentiated language with mere traces of a southern dialect remaining. In 1946, Yuman was spoken by approximately 750 members of the Yuman tribe living on the Fort Yuma Indian Reservation in California.

The Halchidhoma (and the Kohuana)

Prior to 1776 these Yuman speaking people lived along the Colorado River at Parker, almost halfway between Mojave to the north and the Yuma to the south. But the Mojave later drove the Halchidhoma and the Kohuana south from Parker toward the Yuma. Eventually, the Mojave pushed them to the east and they merged with the "East Pima" or Maricopa Indians of Arizona. The Kohuana abandoned their alliance with the Yuma and allied with the

Maricopa at Maricopa Wells.

In 1776 there were reported to have been 3000 Kohauna living on the east side of the Colorado, whereas the Halchidhoma were reported to have numbered 2500. When the Americans came in 1850, these groups were merged among the Maricopa, and of the seven or eight related but warring Yuman nations that once lived on the banks of the Colorado, there remained only three: the Cocopa, Yuma, and Mojave and a fragment of a fourth, the Kamia.

The Mojave

The country of the Mojave is the valley which bears their name and lies in what is now three States--California, Nevada, and Arizona. As the channel of the Colorado River has flowed in recent years, most of the bottom lands lie on the eastern side, and it is there that the bulk of the Mojave settlements were located.

The Mojave were one of the few people in California who thought of themselves as a national entity, the Hamakhave--although their settlements were small, scattered, and perhaps occupied only for short times.

In 1770 there were about 3000 Mojave. By 1910 this number was reduced to about 1050.

INDIANS IN THE DESERT

Many key recreation areas were, for the most part, the same as those lands which were occupied by the Indians. Historically, it would be possible to locate most of the villages of these people. Prehistorically, we would have to assume all areas as having at sometime been used.

Preservation, in any of its many forms, is the only means of preventing loss of important information. Cultural process is non-repeatable. The fact that past events are "frozen" in the archaeological record should only be thought of as preservation in its weakest sense. Preservation of dynamic human events (i.e., process) is unlike any other kind of preservation because it cannot isolate phenomena. It can only record events through time. This is a concept that is characteristically anthropological and not historical.

It is even more crucial now to preserve contemporary Indian culture as it was to record it 100 years ago.

The history of public and governmental interests in the California Indians is probably as poor as in any other region of the United States. Although contemporary public opinion often suggests the contrary, the California Indians' success was much greater in terms of contact and competition with the Spanish than with Anglo-Americans.

Both branches of the white race arrived on the Pacific Coast with a heritage of long experience with the Indians; both had developed a well-formulated mental attitude and a definite policy with respect to the natives. But these attitudes and policies were conditioned by the widely differing pioneering and colonial experience of the two branches in the preceding centuries. Both Anglo-Saxons and Spanish had pursued exploitation of New World resources. The Spanish, however, had systematically availed themselves of human resources, whereas the English had tapped only material wealth. That is to say, the aboriginal race was an economic asset to the Spanish and as such was to be conserved. The Anglo-American system, on the other hand, had no place for the Indian.

HISTORY

Until the coming of the railroad and the automobile to the southern California deserts, the rugged mountains and the barren wastes of this immense region were obstacles in the path of people seeking a promised land. Thus the earliest history of the area is largely a chronicle of explorers and pioneers seeking and establishing routes of travel through the difficult land. Few chose to remain east of the coastal ranges.

Then, as the Argonauts pushed toward the California gold fields and later, as disappointed miners fanned out from the Mother Lode in search of richer pickings, people discovered that the southern California deserts held mineral wealth. Prospectors swarmed over the area, and miners and mining camps were established to extract the precious ores. Gold was the principal lure, but as the nation became more industrialized the base minerals--borax, talc, and many others--inspired the greater activity. Towns, transportation stations, and industrial plants flourished and then were deserted as lodes were exhausted or mining interests shifted.

Since the turn of the present century the introduction of large-scale irrigation has changed the appearance and the economy of much of the desert. Populous centers have grown up where water could be made available, and the more rugged and arid regions have become favorite recreation areas for the residents of both desert and coastal cities.

The shells and ruins of once-flourishing towns, mines, and way stations are now prime resources for increased enjoyment and understanding of the southern California deserts. Although many of the most important historical sites are now in heavily populated areas or in private hands, many others are publicly owned and are available to visitors. An attempt is made here to indicate the main emigrant routes and the gold mines and camps that were important in the early history of California and that can serve to enhance a desert experience.

Although he was not the first white man to cross the Colorado River, Captain Juan Bautista de Anza was the first man to lead an expedition expressly for the purpose of blazing a trail through the California desert to the coast. Accompanying him was Father Francisco Garces.

De Anza and Garces reached the junction of the Gila and Colorado Rivers on February 7, 1774, and two days later camped on the California side at the ford above the Gila. They followed the river past Pilot Knob and camped at the place where the Mission San Pedro y San Pablo was established in 1780. This was near Yuma just above the boundary line, and from here the expedition continued southwest until it reached a lake that Anza called Laguna de Santa Olaya, 12 miles south of the boundary and 8 miles west of the Colorado. The party re-entered California on March 7, 3 or 4 miles southwest of the Yuha Well, then proceeded to the junction of the San Felipe and Carrizo Creeks. This place is now known as Harper's Well, about 10 miles west of the southern end of the Salton Sea. The expedition entered the mountains by way of San Felipe Canyon and San Carlos Pass.

De Anza then entered what is presently San Diego County via San Felipe Creek. He camped at San Gregorio (at the entrance to Borrego Valley), then at Santa Catarina in Coyote Canyon at Reed's Springs (or Lower Willows), just above Beatty's Ranch. The next day his party entered Riverside County.

The party passed about 8 miles southeast of the little town of Anza, then through Cahuilla Valley to Dry Lake. It proceeded to the head of Bautista Canyon, descended the canyon to the San Jacinto River, camped at the western edge of Jacinto Lake, proceeded through Allessandro Valley, and descended by way of Sycamore Canyon. The party then crossed the present site of Riverside and proceeded northwest to San Gabriel and Monterey.

Anza's expedition had proved successful, so that upon his return to Mexico plans were immediately begun for transporting settlers to California via the land route. In 1776, Anza again led an expedition through the desert, using pretty much the same trail as before, with the following variations: In present day San Diego County he marched through the little pass called Los Puertecitos, then camped at San Gregorio. The party also camped at El Vado and at Santa Catarina. In Riverside County Anza made one variation from his previous route. After leaving Lake San Jacinto the company went through Bernasconi Pass and across Alessandro Valley by way of March Field to the old campsite on the Santa Ana River.

Another trail was blazed by Pedro Fages in 1781 and 1782. The route he followed eventually became known as the Old Emigrant Trail. It followed Anza's trail to the San Felipe watering place, then turned up Carrizo Creek to the southwest. It then went by way of Vallecito, over the Cuyamaca Mountains to Warner's Ranch and then to San Diego Mission.

Jedediah Strong Smith was the first American pathfinder to enter California overland. In 1826 he set out from Salt Lake City and passed along the east side of the Sevier River. He then turned southwestward into a mountain range, south again across the Beaver River to the lower course of the Virgin River. He proceeded down the river to the Colorado, crossed the latter to the Mojave Indian villages around Needles and then went across the desert and up the Mojave River to its western headwaters in the San Bernardino

Mountains. Crossing the range eight miles east of the Cajon Pass, Smith came down into the San Bernardino Valley on the ridge between Devil and Cable Canyons, crossing Cajon Creek between Devore and Verdemont. From here he skirted the base of the foothills to Cucamonga, to San Gabriel and the sea. This was the Mojave Indian Trail. It is important because it antedates the Cajon Pass route.

Another major trail into California was the old Spanish Trail, opened by William Wolfskill in 1831. Although a few others had passed this way before, Wolfskill's route was the one most frequently used. The Spanish Trail began in Sante Fe and ended in Los Angeles. From Santa Fe it swung north into Utah, its most northern point being the town of Castle Dale. From there it went in a southwesterly direction, crossing Nevada near Bunkerville and going by way of Las Vegas. The trail came into California near Resting Springs in Inyo County, then went by Salt Springs, Bitter Springs, Barstow, Victorville, over the Cajon Pass, skirted the east side of the San Gabriel Mountains (like the present highway) to San Bernardino, then to San Gabriel and Los Angeles. The route between the Cajon summit and San Gabriel was that followed by the Mojave Indian Trail as well.

Caravans from Santa Fe often used this trail as did many Morman emigrants. Hence it was also known as the Santa Fe Trail and the Morman Trail.

As more settlers crossed the desert the need for protection from hostile Indians became apparent. Along the Mojave Indian Trail the government established several forts between Fort Mojave and San Bernardino. This stretch of road thus came to be called the Old Government Road, and went from Fort Mojave to Piute Springs, Rock Springs, Government Holes, Marl Springs, 17 Mile Point, Fort Soda, the Caves (Afton Canyon), Camp Cady, present day Daggett and Barstow, and on to Nelendals, Point of Rocks, Victorville, Cajon Pass, Canyon House, Martins, and San Bernardino.

One of the forts along this road was Fort Piute, established in the early 1860's about 25 miles west of Fort Mojave. It was actually an outpost of Camp Cady, rather than a complete military establishment. Outposts were established on the Old Government Road to provide relief for the soldiers and their mounts while on patrol. Behind the fort is a ravine where the ruins of the stockade may still be seen. Some of the old rock walls also remain, open to preservation and interpretation.

Before the building of the railroads one of the most serious problems faced by Californians was the lack of a system of communications with the restof the continent. To fill this void, the Butterfield Overland Mail Company began running stages between St. Louis and San Francisco in 1858. A southern route was chosen, partly for political reasons, partly because the route was open all year round.

After crossing the California border at Yuma, the Butterfield stages went by way stations at Pilot Knob, Cooke's Wells, Gardener's Wells, Alamo Mocho (the last three were located in Mexico), Calexico, Indian Wells, Hall's Wells, Carrizo Creek, Palm Springs, Vallecito, San Felipe, and Warner's Ranch. From Warner's Ranch the stages continued north to San Francisco.

Another stage route was established between 1863 and 1877. This was the Bradshaw route which ran between San Bernardino and La Paz on the Colorado River. The route went by way of Ehrenberg, Chuckwalla Well, the Coachella Valley, Palm Springs, and Beaumont.

On July 1, 1866, Congress granted extensive areas of public lands to two railroad companies for construction, operation, and maintenance of the transcontinental railroad system. Union Pacific and Central Pacific (parent of today's Southern Pacific Company) were granted the alternate odd numbered sections to a depth of 10 miles on either side of the line, plus additional lands for stations, shops, and other uses. Altogether in the United States, a total of more than 20 million acres was granted under this act, portions of it in the California Desert. This accounts for the characteristic checkerboard pattern of land ownership in many areas, and although the railroad companies sold off some of the granted lands, today the Southern Pacific Company is one of the largest private landowners in the California Desert region.

Mining in California was not confined solely to the gold country of the Mother Lode. "Desert Rats" prospected the eastern Mojave desert and mountains not only for gold and silver but for other kinds of minerals as well.

There are remains of at least a dozen mining towns in Death Valley, even more in Panamint Valley. One such town was Panamint City. In 1860-61 prospectors discovered gold and silver in Surprise Canyon in the Panamints. Hostile Indians and steep canyons prevented further exploration until 1872, when three prospectors discovered ore of silver and copper value. These men soon organized the the Panamint Mining District. During the winter of 1874-75 Panamint City reached its peak. It had a population of 5,000 and included the usual assortment of saloons, houses, and stores. Thousands of dollars worth of ore were shipped out of such mines as the Wonder, Hemlock, and Wyoming.

However, Panamint suffered the fate of many another mining town. As soon as the ore supply was exhausted the miners left. In 1876 a flood washed away much of the town and today only a few ruined stone walls and the foundations of a mill remain.

Another mining town of the Mojave Desert was Calico, in the Calico Mountains, where silver deposits were discovered in 1881. The mines, including the Silver King and Waterloo, shipped $65 million of silver from the district. Borax was also discovered near the town, as were lead and copper. Borax was also found in Death Valley, and the borax industry continues to this day.

Calico reached its height in 1886, but by 1892 the richest veins were exhausted and five years later the camp was deserted. Structures made of adobe have endured to the present; the rest of the town has been restored.

Still another town was Picacho, 25 miles north of Yuma. It was first located by Mexican prospectors in 1862 and thus retained a Latin flavor throughout its existence. Rich lodes were found nearby so that payrolls averaged $40,000 per month. The Picacho and the Golden Dream were only two of the mines in the area. All but a few of Picacho's buildings vanished, but the townsite is now being developed as a state park and recreation area.

Another mining district existed at Tumco, five miles north of Ogilby Station on the Southern Pacific. Only ruined walls and foundations remain of a city which once boasted a population of 2,000. The Tumco mines operated from 1884 to 1914. The most famous of them were the Golden Queen, Golden Cross, and Golden Crown. Five miles northeast of Ogilby was the American Girl mine. Near the San Bernardino-Kern County line the remains of the towns of Atolia and Red Mountain mark the Rand Mining District.

The history of gold and silver mining towns is the same in the desert as in the Mother Lode: A town grew until the strikes were exhausted, then declined and finally vanished. Today other minerals, such as borax, are mined more extensively in the desert than either gold or silver.

More recent history in the desert is primarily concerned with the effort to bring water to this area. The successes are evident today in the Imperial Valley where Colorado River water has created a lush agricultural district. In this process, one event made a dramatic impact on the desert landscape, and is an interesting historical note.

By about 1902, the canals carrying water from the Colorado River to Imperial Valley began to silt full. This interfered with the delivery of water. When engineers began opening levees to divert the water to new channels, insufficient controls were used and this, coupled with a series of spring storms, caused complete loss of control of the diverted water. By 1906, a full 40 percent of the river's flow was by-passing the irrigated fields through the new channel it had cut (New River) and emptying into the dry bed of ancient Lake Cahuilla, now known as the Salton Sea.

Though the depth of the Sea has decreased more than 40 feet from its 1907 maximum, it now supports an important sport fishery activity, together with boating, water skiing, and other water-based recreation. In 1963, the Sea provided an estimated 325,000 angler-days of fishing. By 1980, it is estimated that this use will increase to one million angler-days. (Figures from California Department of Fish and Game).

The study area still has visible remnants of its history, for although men did not easily settle the desert they left traces of their passage. These remnants, usually in the form of ruins or sites, indicate the kind of history which occurred there. The preservation of these areas would make it possible to present history in a visual, lively manner instead of relying solely on the written word.

The ruins of such way stations as Pilot Knob, for instance, can still be seen. The possibility exists of restoring it to allow for visitor inspection.

Or, the visitor could follow an old trail, stopping at the campsites of early explorers. Parts of the old roads can still be identified, as can old campsites.

The opportunity to see the old saloons, stores, shacks, and homes would clearly convey a picture of life in a mining town. Moreover, with the use of old mining equipment a mining scene could be authentically recreated. Probably many persons today have no idea of how the frontier miners worked.

Among other sites of historical significance which might have recreational value are old railroad towns, such as Kelso; the remains of an old plank road, one of the first auto roads in the desert; the remains of the Fort Yuma buildings; the site of three ferry crossings at the Colorado River; and the site of Camp Salvation, a refugee center for emigrants going to the gold fields over the southern route.

An historic site not only provides the historian with visible information of years past; it can provide an enlightening and entertaining experience for the visitor by giving him glimpses of a style of life different from his own.

Unfortunately today the historic remains of the past are being destroyed at an ever increasing rate by vandals, collectors, and the uncontrolled use of millions of people who are not aware of the values they are inadvertently eliminating.

EDUCATIONAL RESOURCES

The following report was prepared for the Bureau of Land Management by Rudolph J. H. Schafer, Consultant in Conservation Education, California Department of Education, Sacramento, California

A recent public opinion poll conducted in California indicated that approximately 10 public issues were mentioned over and over again by citizens as being of major importance to them. When asked to rate these issues in terms of urgency, conservation and environmental issues were ranked third--just behind "crime in the streets" and"high taxes". This poll is just one more indication of the fact that Californians--as well as most Americans-are concerned about what is being done to their environment and its resources, and are anxious to reverse the trend toward their destruction.

This concern for conservation has caused many citizens to look to their schools for help. A generation of youngsters who understand their interdependence with their environment and who have an environmental conscience may be the only way out of our dilemma.

In response to this concern, the Legislature, as a part of the Miller Education Act (Senate Bill 1, 1968 Session) required for the first time in the history of California that conservation and man's relations to his human and natural environment must be taught at all grade levels in the schools of California. As a result of this legislation and local pressures, school districts and county school offices have been busy as never before developing new programs and upgrading older ones. In order to assist districts in this work the Legislature created a Conservation Education Service in the Department of Education and authorized state planning grants to assist in the work of developing new programs.

One of the most promising educational developments designed to help children develop an environmental awareness has been the outdoor school. Under such programs, students and their teachers spend 3 to 5 days or longer in an outdoor location studying ecology and participating in conservation projects under the direction of trained specialists. In 1968, 60,000 students participated in such programs, and the trend is upward. At present these programs are usually limited to elementary-age students, but pilot projects involving secondary students are underway.

To be effective, an outdoor school requires about 200 acres of land to provide room for all activities and living facilities. Locations providing a variety of ecological study areas are preferable. The school district need not own the entire area, but normally requires ownership of the land upon which district-owned facilities are to be built.

The vast amount of public land in Southern California offers a great potential for expanding the outdoor program to more elementary and secondary students from crowded urban areas. At present, there are some 2,647,800 such students in Southern California, and this number is expected to grow to 2,839,800 by 1980.

Day and short-term use of public land is also desirable in school programs. Last year the Los Angeles City Schools alone provided 6,979 class visits to study locations away from school buildings. This trend toward greater utilization of community resources in the educational program is also expected to increase in the years ahead.

As more and more students take advantage of the opportunities offered them in the field of higher education, the need for outdoor study areas in the natural and life science fields is expected to increase. The two-year junior college program in Southern California alone is expected to involve some 1 million students by the year 1980.

In summary, it might be said that the public lands represent a huge outdoor classroom which could be used to enrich the educational program offered the youth of Southern California. These lands, properly used, could help students develop an environmental conscience which could well be a pivotal factor in reversing the trend toward destruction of our land. To let this valuable resource get away from us through carelessness or a lack of intelligent planning would indeed be a great tragedy.

THE RANGE RESOURCES

On about one-third of the California Desert, the dynamic desert ecosystem reached its present ecological stage with domestic livestock as a component for the last 90 years. The many studies dealing with ecological changes in the desert vegetation attribute these changes to several factors, including climate, rodents, and livestock use.

Studies dealing with livestock use emphasize its effects on the spread of shrubby plants by transporting seed and vegetative parts of plants, as well as influences of overgrazing.

Of the factors considered, climatic change and grazing use have in the past exerted the most influence on vegetation change. But more recently there are indications that the mechanical scarification of vegetation by 4-wheel drive vehicles and motorcycles may have a significant influence on desert ecology. The climate in the California Desert is characterized by periodic droughts, high intensity storms, and dry winds. Only a fraction of the meager precipitation penetrates the soil surface deeply enough to become available for plant use.

Because of the high temperature, a considerable amount of moisture is lost through evaporation. Plant responses to temperature in the Desert are as complex as the moisture responses. Temperature affects seed germination of many plants. With desert annuals it is one of the factors determining their distribution. In some desert plants critical physiological functions require a specific temperature range. Others require a specific temperature range that must coincide with a specific moisture pattern. The frequency, intensity, and duration of freezing control the zonation of plant communities.

The variability in forage production and its availability for livestock grazing is highly erratic and undependable. When favorable climatic conditions prevail, the range produces an abundance of annual vegetation. This sporadic production of annuals in some areas is intermingled with perennial plant production which may be fairly consistent from year to year.

Because of the many differences in plant communities in the California Desert, livestock management criteria must be designed to meet the many vegetative variations. Such criteria must recognize the growth requirements of the forage plant. These criteria must include an understanding of the needs of animals using the range and must also include a consideration of necessary range improvements and a means of identifying other than grazing values. Last, but not least, the criteria must consider the social and economic implications of the range management system on the Desert.

FORAGE AREAS

Annual Forage Areas

The plant communities in this category periodically provide forage of an annual nature. Typical perennial vegetation within these plant communities include creosote bush (*Larrea tridentata*), bursage (*Fransaria dumosa*) mesquite (*Prospis juliflora*), cacti (*Opuntia* spp.), ocotillo (*Fouquieria splendens*), and Spanish dagger (*Yucca schidigera*). Grasses are generally limited to summer annuals, such as 3-awn (*Aristida* spp.), red brome (*Bromus rubens*), and six weeks grama (*Bouteloua barbata*). Browse plants, consisting of bursage (*Franseria dumosa*) and range ratany (*Krameria parvifolia*), contribute to the forage production in the areas suitable for livestock grazing.

The annual forbs, when present, include filaree (*Erodium cicutarium*), indian wheat (*Plantago purshii*), and marigold (*Baileya*) in addition to the annual grasses.

In the years of abundant moisture and other favorable climatic conditions, annual weeds and grasses produce 2,000 to 4,000 pounds of forage per acre. The season is usually short-lived. These favorable years are highly unpredictable and occur about 1 in 5. In about 2 of every 5 years, the forage production is so low the annual range is unusable for livestock; about 3,500,000 acres of the California Desert fall in this category.

Perennial-Annual Forage Areas

The plant communities in this category are range sites that normally produce livestock forage, but in addition to the perennial plant production they periodically provide ephemeral forage. Typical perennial vegetation includes blackbrush (*Coleogyne ramosissima*), joshua tree (*Yucca brevifolia*), hop-sage (*Grayia spinosa*), spiney mendora (*Mendora spinescens*), indigo bush (*Dalea* spp.),winter fat (*Eurotia lanata*), cattle spinach (*Atriplex polycarpa*), golden bush (*Haplopappus* spp.), big galleta (*Hilaria* spp.), black grama (*Bouteloua eriopoda*), and desert needlegrass (*Stipa* spp.). The ephemeral forage includes filaree, indian wheat, russian thistle (*Salsola kali tenuifoloa*),and annual grasses.

In years of abundant moisture and favorable climatic conditions, annual weeds and grasses add materially to the total grazing capacity. The California Desert has about 2,500,000 acres in the perennial-ephemeral forage areas.

RANGE MANAGEMENT

The California Desert holds about 6 million acres of Federal rangeland that is considered suitable for livestock grazing. The BLM manages grazing on this land on a year-long basis with a minimum of direction or control. Nearly 20,000 to 25,000 cattle, and 100,000 to 140,000 sheep graze in the desert on the good years growth, using 135,000 to 180,000 animal-unit-months of forage.

Management Plans

The Bureau allows livestock owners to graze their animals on BLM land under a permit or lease arrangement. It develops management plans in cooperation with range livestock users. The plans specify an action program that applies the intensity of management needed to reach specific goals for the site. The goals must be coordinated with and be compatible with other resources program goals. The grazing system is a major component of the allotment plan. It can schedule, restrict, or both, the livestock grazing so that it will be compatible with these other resource uses.

Two grazing allotments now have intensive grazing management being applied by approved plans. Management plans will be necessary for additional areas having resource problems.

In some allotments, the present intensity of management is considered adequate. But many allotments reflect unsatisfactory range conditions and need more intensive management. Most allotments are grazed year-long whenever forage is available. This practice has contributed to the unsatisfactory conditions.

Most of the grazing allotments include both private and BLM land. This condition emphasizes the importance and necessity of a close working relationship between Bureau personnel and the grazing licensee or lessee.

Range Inventory

A range inventory has been completed on 1,500,000 acres of the allotments. These inventories are necessary as a prerequisite to the development of management plans. They define the extent and composition of the various vegetative types, as well as establish a stocking rate for guidance in developing grazing systems for the allotment management plan. Resource inventories are required on most perennial-annual forage areas.

In allotments, or leases in annual forage areas containint predominantly annual forage plants, little value would be served by making a detailed inventory other than defining the extent of the various types. Therefore, range inventory work will not be emphasized in these areas, and will remain a low priority unless necessary in solving a particular management or legal problem when grazing capacity for a particular season is required. Out of the 6 million acres of grazable land in the California Desert it is estimated that additional resource inventories will be required on 2.3 million acres in both forage type areas.

PROBLEMS

Vegetation

Several species of poisonous plants are found on the California Desert that present livestock and management problems. Livestock loss due to lethal consumption of these plants is not readily apparent. The effects are often accumulative, and some time may be required before the damage is evident. The potential hazard is greatest when livestock are put on the range before adequate nutritious forage is available, or when the livestock are left on the range after the more palatable forage plants are consumed. These conditions or situations are quite common when a range manager attempts to rely on annual vegetation to sustain his livestock.

Some of the more common poisonous plants include loco (Astragalus spp.), thickleaf drymary (Drymaria pachyphylla), golden weed (Haplopappus spp.), annual lupine (Lupinus spp.), nightshade (Solanum spp.), and cocklebur (Xanthrum spp.), milkweed (Asclepias spp.), greasewood (Sarcobatus vermiculatus).

Areas where poisonous plants present management problems must be identified and considered when designing the grazing system for the allotment management plan.

Another significant problem within the California Desert is the sporadic production of annuals. Not only is it a gamble in trying to forecast or predict when a supply of forage will be available, but the duration of the supply is also highly unpredictable. This uncertainty presents livestock handling and related economic problems of great magnitude.

The balance of plant life in the desert is easily upset, and once this occurs the rebuilding process is much slower than in zones of milder climates and higher rainfall. Desert shrubs used for livestock forage on the Desert Experimental Range in Southern Utah have taken 25 to 35 years to progress from poor or bad condition to good, even under intensive management. The

California Desert is more arid and expected progress slower. Therefore, adequate knowledge and proper management of the forage resource is critical.

Livestock

When unregulated livestock graze the Desert Area they usually scatter over a large area, depending upon water and forage conditions. Their owners usually give them only slight attention. When this situation exists and unregulated travel by the recreationist or general public prevails in the area, livestock losses from theft, disturbance, and shooting becomes significant.

People

Recreationists tend to congregate or camp near sources of water. At times this concentration prevents livestock from watering and becomes a significant problem because of the limited water supply in the Desert Area. Feral burros also compete for forage and water.

Indiscriminate and malicious use of firearms by recreationists within the Desert Area also takes its toll in livestock losses, as well as damages water tanks and other facilities. Gates left open and fences and other facilities damaged by vandals always present problems when livestock and other conflicting uses are not coordinated and supervised.

PROPOSAL

Factors that affect the role of Desert ranges include competition for land for other than grazing use, and livestock economics. The livestock producers will be facing the need to market a higher quality product. When livestock are scattered over large areas of marginal grazing lands, it is difficult to exercise the necessary livestock control, and these fringe operations may go out of business.

Management Needs

The most logical way to manage the range resource within the California Desert Area is to develop management plans that identify the problems and define the management objectives. Present resource information is inadequate for this purpose. Until each allotment management plan is developed, it is impossible to determine the extent of facilities, such as water developments and fences needed.

And livestock and range management programs must recognize the vegetation responses and demand on the vegetation by other than livestock uses. This may require restricting or eliminating livestock use from some areas, and possibly scheduling other resource uses, such as cross-country dune buggy and motor bike races, where they will not present conflicts.

Benefits

It does not appear that increased management of the range resources will result in a significant increase in forage, nor is there much opportunity for forage development (seeding or reseedings, etc.). The major benefit from grazing management will be derived by maintaining a ground cover that will sustain a more stable forage use and will enhance the values of such other resources as watershed, wildlife habitat, recreation, and scenery.

THE RECREATION RESOURCES

Rich in recreation resources, with unique natural features, significant sites of archaeologic and historic interest, and a variety of associated values. This is the California Desert. For many generations, the Desert has offered a wealth of opportunities for outdoor recreation. In the last two decades, increased leisure time, prosperity, and greater mobility have enabled more people than ever before to journey to the Desert for recreation. Until recently, little research was done to collect and analyze background data on recreation use in the Desert Area.

THE 1968 STUDY

In 1968, the BLM's California State Office and the National Park Service's Western Regional Office joined forces to assess the development and management of outdoor recreation on BLM land in the California Desert. Their report -- titled "The California Desert" -- is a preliminary study primarily concerned with recreation in the Desert Area. It includes recommendations of how recreational resources can be conserved, developed, and managed, and their wise use encouraged.

Recreation Findings

In addition to picnicking, camping, and hiking, the survey found that Desert visitors enjoy many other activities. They include driving for pleasure, sightseeing, observing desert flowers, and taking photographs. And there were such specialized activities as hunting, target shooting, rockhounding, archery, wilderness experiences, scenery painting, cross-country motorcycling, and dune buggying.

These specialized activities often present their own unique problems. Some activities require many acres of land for proper enjoyment, while others, such as archery or target shooting, require only the use of very limited acreage. Some activities need a particular kind of area with certain geologic or atmospheric conditions...mountain climbing, dune buggying, or sail plane flying, for example. Or they may need the presence of particular resources, such as wildlife for hunting, or certain minerals for rockhounding.

Other Findings

Other main findings in the 1968 study were: Travel to the Desert: in pickups, or pickup-camper combinations--51 percent; in sedans or station wagons--39 percent; in four-wheel drive vehicles--8 percent. (Survey data did not include organized groups such as motorcycle clubs,or school field trips.)

Age groups using the Desert: Adults--63 percent; younger children--24 percent; teenagers--13 percent.

Types of trips: Weekend-overnight--58 percent; others--42 percent. (To get to their destination in the Desert, 46 percent of the visitors traveled more than 150 miles from home.)

Length of visit: 2 or more days--59 percent; 4 hours or less--14 percent; other--27 percent. (The long travel distances probably account for the extended stays in the Desert.)

Frequency of visits: First visit--24 percent; visit at least two or three times a year--28 percent.

Recreation activities: Camping and sight-seeing--50 percent; hiking--13 per cent; rockhounding --12 percent; motorcycling-- 9 percent; dune buggying--9 percent; hunting and target plinking--3 percent. (The motorcycle use is exclusive of all sanctioned motorcycle races on public lands, which alone accounts for 375,000 to 450,000 visits a year. The field survey was conducted during the spring. Therefore, the figures for hunting use did not reflect the true number of sportsmen who travel to the Desert Area in pursuit of game animal or bird.)

Destination: Desert is main destination--79 percent; Desert was an equal destination--15 percent; Desert was not main, equal, or secondary destination--2 percent.

RECREATION MANAGEMENT

In planning for the management of a quality recreation environment in the California Desert, the Bureau's objective is to manage its lands in a manner which will protect the health, safety, and comfort of the visitor while preserving and protecting its natural values and valuable resources.

Federal Agencies

Bureau of Land Management -- With the passage of the Classification and Multiple Use Act in 1964, the Bureau began a detailed recreation inventory of lands within the Desert having high recreational values. This work was followed by detailed planning leading to the development of recreation facilities at Afton Canyon, Owl Canyon, Rainbow Basin, Wiley Well, Coon Hollow and Corn Springs. Additional recreation sites are awaiting construction funding.

As a part of the Bureau's recreation program in the Desert, 49,733 acres in San Bernardino, Imperial, San Diego, and Riverside Counties comprising some 43 recreation and archaeological sites and natural areas have been proposed for withdrawal from all forms of appropriation, including mining laws, but not from mineral leasing. The National Park Service has designated several areas within the California Desert as National Natural Landmarks. And more are now being considered.

In addition to maintaining developed campgrounds in the Desert, the Bureau is now exerting considerable effort, desert-wide, to clean litter and trash that has accumulated over many years by thoughtless users.

National Park Service -- The Park Service administers two large areas within and adjacent to the California Desert: Death Valley and Joshua Tree National Monuments. Both have numerous facilities and excellent management programs developed for visitors.

The NPS also cooperates with other agencies in the development of recreation-oriented programs in the Desert. An example is a feasibility study of the Lower Colorado River Valley Parkway in cooperation with the BLM's Lower Colorado River Land Use Office at Yuma, Arizona.

Department of Defense -- The Department of Defense has jurisdiction over 2.5 million acres of Desert Land. Portions of these lands receive recreation use. Because of the nature of the military's operations, it excludes the public from most areas for safety and security reasons.

Military installations in the Desert Study Area include: Edwards Air Force Base, Camp Irwin, U.S.Naval Ordinance Test Station at China Lake, Randsburgh Wash Test Range, Marine Corps Artillery Training Center, and the Navy's Camp Dunlap.

State and County Agencies

California Department of Parks and Recreation -- The State of California has a fine history of recreation management in and adjacent to the California Desert that dates from the mid-1930's when it acquired Anza-Borrego State Park. Since then it has developed excellent facilities at Salton Sea, and Joshua Trees and Mitchell Caverns State Park.

The Parks and Recreation Department is now studying the desert landscape province. The first phase of this study is designed to determine the basic resources in the area, with emphasis on historical, geological and natural scenic qualities.

Imperial County -- Owing to budgetary limitations Imperial County has been restricted in its efforts to develop and maintain recreation facilities in the Desert Area. The county has concentrated its activity mostly in the populated areas and in heavily traveled highways. For example, Hugh Osbwin County Park with limited facilities, is on State Highway 78, about 4 miles west of Glamis in the Imperial Sand Hills. Also, water-oriented facilities have been provided around Salton Sea.

Riverside County -- Riverside County appears to be limited in funds to develop facilities in the Desert. County efforts are directed towards main arteries of travel, populated areas, and the Salton Sea where use is heavy. The remote areas are planned and coordinated with the BLM and other federal agencies having land jurisdiction in the county. More detailed information is available in the General Plan of Regional Parks, Riverside County.

San Bernardino County -- San Bernardino County, too, is limited in funds, and will look to the State's Park and Recreation Department and the BLM for support in developing and protecting the Desert resources in the county. The County has adopted a desert plan within its General Plan of Regional Parks. This plan was developed through the cooperative efforts of San Bernardino County Planning Department, the BLM, State of California's Parks and Recreation Departments, Forest Service, and San Bernardino County Flood Control Department.

Private Investments

Private planning efforts appear to be water-oriented and concentrated in areas along the Colorado River, the west side of the Salton Sea, and-in a minor effort-east of Barstow along the Mojave River.

Catering to the mobile population has stimulated a winter tourist industry along the Colorado River. Considerable planning and development are available to the visitor who comes for an extended stay to enjoy winter homesites, trailer parks and marinas.

Around the Salton Sea, planning is concerned with services catering to the weekend visitor from Los Angeles and San Diego areas and with providing desert homesites.

The recreation lakes developments along the Mojave River drainage east of Barstow are servicing primarily a local demand in day-use of swimming, boating, and fishing facilities. In some instances, larger lakes are being developed for rural homesites to be located around them.

PROBLEMS

Resource Losses

Present recreation use of the Public Domain Land in the California Desert is virtually unregulated. We estimate that the Bureau of Land Management has developed facilities to handle less than 1 percent of the annual recreation use in the Desert. Damage to natural, scientific, and recreational values is occurring and cannot be repaired. Expansion of suburban developments, water, power, gas, and other transmission lines are taking their toll of natural recreation resources. Losses in historic and archaeologic sites have been heavy. Construction of roads has contributed considerably to the loss of scenic vistas and cultural resources.

The inventory and reduction of hazards on the desert public lands is necessary. However, since no funds or manpower have been provided very little work has been done on hazard reduction on the public lands in the California Desert.

Pollution is evident in many forms. Visual pollution can destroy the Desert before air pollution has a chance. Scars of World War II military maneuvers are nearly as visible from the air today as when they first occurred 25 years ago. Noise pollution can permeate miles of the Desert, destroying the serene effect created by an otherwise tranquil area. The noise problem stems from a variety of causes -- from cross-country motorcycle use, to sonic booms by military aircraft on training exercises.

The removal of resources is occurring at an ever increasing and alarming rate. Various vegetative specimens are not only being removed, one at a time, but are removed en masse from certain areas to the detriment of future desert visitors. Mining activity has left its mark on the Desert. And time alone will not be able to heal the visible scar. If uncontrolled use of the California Desert is allowed to continue, widespread deterioration is inevitable and irrevocable.

Limitations

The ownership pattern in the Desert includes private inholdings, checkerboard grants, military and reclamation withdrawals, and state school sections within the California Desert. This pattern imposes problems for the development of the full recreation potential. And present regulations do not allow the Bureau to purchase access to public lands and key inholdings outright in order to alleviate management limitations.

Among the other limitations facing the Bureau are:

The Recreation Regulations of January 18, 1969 identify circumstances under which use of lands may be restricted in order to protect the public health and safety and the natural resources and other values. Lack of enforcement of these regulations is of great concern to Bureau field personnel.

The continued fragmentation of the public lands through special use permits, leases, and patents for recreation purposes lead to fragmentation of land management units and administrative responsibilities. This results in complicated interagency agreements to implement multiple-use management objectives.

Primitive (wilderness) and cultural values (archeological and historic) are frequently destroyed by accelerating public use, overdevelopment, and lack of protective authority.

The Antiquities Act does not distinguish between major and minor objects of antiquity or scientific interest.

The general mining laws permit exploration of the public lands at the discretion of prospectors who, in many instances, do not have valid discoveries.

The Taylor Grazing Act, Classification and Multiple-Use Act, Federal Antiquities Act, and Petrified Wood Act authorize the management of the public lands for the conservation and protection of the resource values, but do not provide a means of enforcing these laws.

People and motorcycles cannot be properly controlled where they threaten or disturb public land resources or accepted uses because Legislative authority which permits expeditious enforcement of rules and regulations is lacking.

On a day-to-day basis, the BLM has only a limited number of field personnel to assist the public and provide surveillance over the public lands. Accidents, trespass, and illegal activities go undetected. Opportunities to assist the desert visitor and perhaps to prevent a tragedy go unheeded.

PROPOSAL

The report "The California Desert" pointed out that the study area has the physical size and natural attributed essential to satisfy future demand. This demand could soar from 4.9 million visitor-days [1/] now to nearly 50 million visitor-days of recreation

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[1/] A recreation visitor-day is the accumulation of 12 hours of recreation use.

use by the year 2000. This is based on a program that identifies areas having recreation interest coupled with a facility development schedule that allows wise controlled use of the desert lands. Without this program the desert public lands will probably not receive over 14 million visitor-days of use by the year 2000.

Policy

As recreation philosophy has developed over the years, certain basic concepts have been recognized and generally accepted. Two objectives of publicly supported programs are fundamental:

. Preserving for the enjoyment of future generations, representative examples of our natural and cultural heritage.

. Providing recreation facilities that are both adequate and conveniently accessible.

If these objectives are to be reached, a comprehensive, balanced plan is required--a plan developed cooperatively by all groups and agencies concerned, including local, state, federal, and even private entities.

Recommendations

The 1968 California Desert Study recommended that the Bureau take the following steps in developing a Desert recreation program:

. Set up a criteria for determining the boundaries of recreation lands in the Desert so as to include all potential recreational, historical, natural, and scientific values.

. Evaluate all special uses, sales, and transfers in the Desert with consideration for recreational values in the multiple-use management of Desert lands.

. Consider, in a comprehensive plan for the Desert, those key withdrawn areas with high recreation use and estimate the funds and manpower necessary to clear the land of ordnance and unauthorized uses.

. Consider fully the visual appearance of the Desert in all future development on public lands, and act to minimize or erase existing scars on the landscape.

. Seek legislative authority to enforce rules and regulations necessary for public recreational use of the Desert and for the protection and management of the area and its resources under the multiple-use concept.

. Set up a system of patrol for the Desert, with uniformed rangers assigned geographic areas of responsiblity.

- Plan recreation developments in the Desert to meet demands, but at the same time provide unique opportunities for solitude, adventure, and separation.

- Plan, program, build, and operate a Desert Center and a system of way-stations on primary highways leading into the Desert.

- Encourage concessions and private investments in public accommodations and facilities, as the need arises, to serve visitors to the public lands in the Desert.

- Develop a system of roads throughout the Desert through cooperative planning with State and local governments.

- Evaluate the specialized recreation activities and special provisions they may require for public enjoyment, safety, and protection of the Desert environment.

- Develop facilities for off-road vehicular recreation.

- Work with motorcycle-user groups to select areas and develop facilities for motorcycle centers on public lands where damage to resources would be minimal.

- Undertake a major interpretive program by providing educational and informational materials about Desert lands to the public.

- Negotiate cooperative agreements with universities and scientific institutions to recognize and identify valuable natural or scientific resources in the Desert.

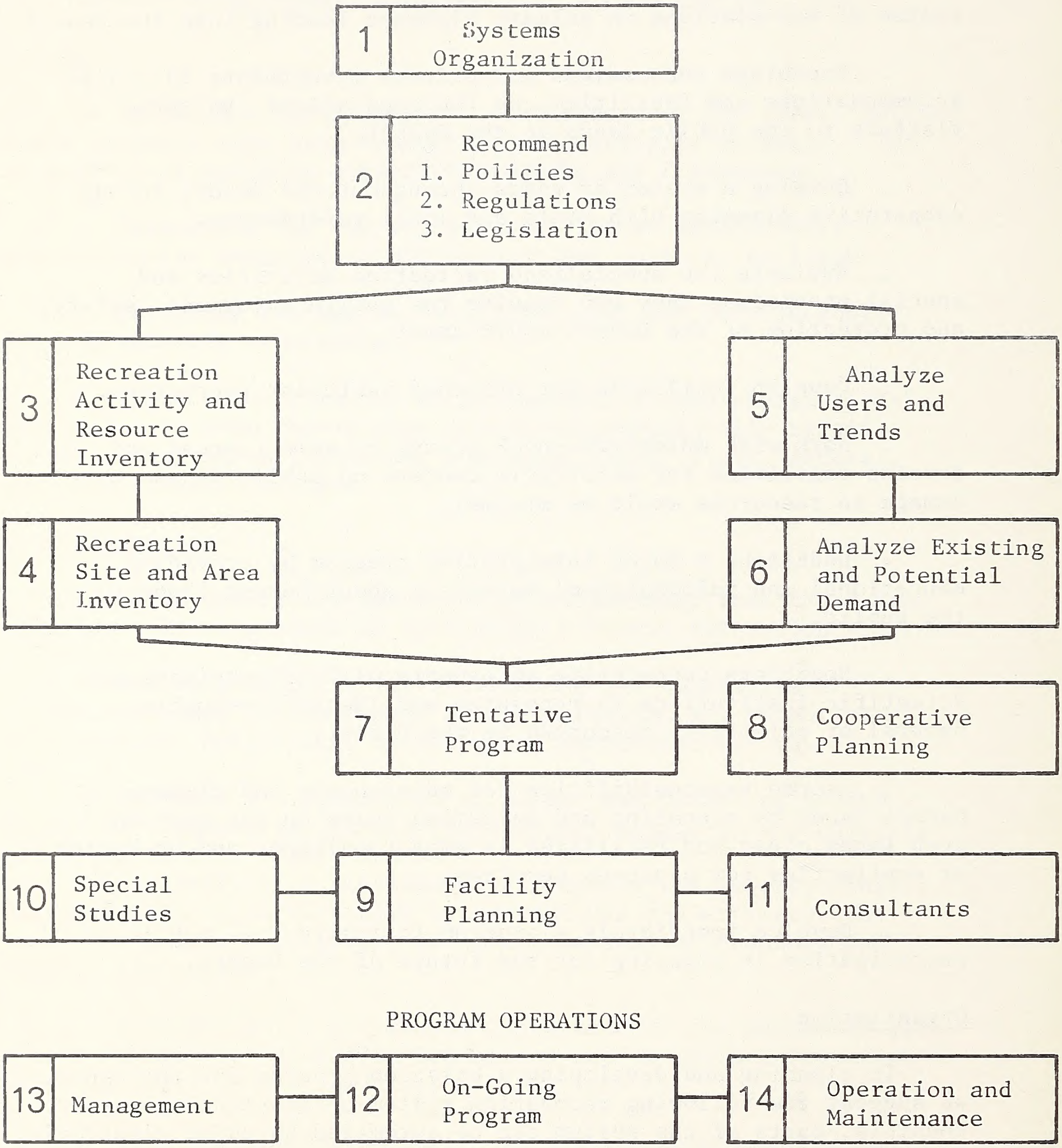
- Assume responsibilities for maintenance and cleanup in Desert lands by educating and informing users on the need to keep lands clean and facilities in good condition, and by hiring or contracting for clean-up services.

- Develop immediately a program to insure full public participation in planning for the future of the Desert.

Organization

In planning and developing a balanced program for the Desert, we suggest the following recreation system be adopted. Wherever possible, parts of the system can be automated by using electronic data processing. But judgment, however, will continue to be the basis for planning.

CALIFORNIA DESERT RECREATION SYSTEMS
FLOW CHART


1 Systems Organization
2 Recommend 1. Policies 2. Regulations 3. Legislation
3 Recreation Activity and Resource Inventory
4 Recreation Site and Area Inventory
5 Analyze Users and Trends
6 Analyze Existing and Potential Demand
7 Tentative Program
8 Cooperative Planning
10 Special Studies
9 Facility Planning
11 Consultants
PROGRAM OPERATIONS
13 Management
12 On-Going Program
14 Operation and Maintenance

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1. The systems organization is made up of three major elements:

   1. An Advisory Council including representatives of user groups, conservation interests, and enforcement specialists. The group should not exceed 15 members. It would insure a representation of the public interest.

   2. Legal Council to inform the Advisory Council on Federal laws and interpretations of laws.

   3. A Division of Recreation that would be responsible for furnishing technical information to the Advisory Council, and State Director and assembling data into (a) policies, (b) regulations, and (c) legislation.

2. These data would be recommended by the Systems Organization.

3. Natural recreation resources are the "raw materials" of outdoor recreation. They include climate, geologic character of the land, plant and animal life. The amount of the natural resource available will determine how much and where a recreation activity can take place. Therefore, a detailed resource inventory must be developed prior to the planning and construction phases to insure orderly and proper development.

4. Additional Recreation site inventories are needed in addition to 19 areas already studied in order to analyze the total Desert area.

5. Analyze trends that affect us include (1) sharp rise or fall in birthrate (2) shift in urban population (3) increasing leisure time, and (4) higher incomes. Trends and users collectively can accentuate the urgency for preserving unspoiled natural and cultural resources or for shifting development from one area to another.

6. Analysis of existing and potential demands is essential to the success of the system. The term "potential" takes into consideration the desire and ability of people to participate in recreation activities.

7. The tentative program will be brought together here and before further action can be taken, various criteria will have to be developed for use in later planning; examples include facility design standards, desert wilderness criteria, interpretive objectives and standards, and many others.

1/ Numbers in boxes are keyed to those on the flow chart.

8. Cooperative planning is required if regional recreation goals are to be attained.

9. In facility planning there is a great number of planning levels to deal with. Possibly the first is the identification of sites or areas where recreation facilities can or should be located. Another consideration is whether access should be made available in all cases . Open space is a positive and functional land use that should be designated and planned for. Building locations will have to be another consideration in the over-all plan.

10. Special studies include administrative facility studies, and special underground water studies to determine the availability, quantity, and quality of water in certain areas of the desert.

11. Consultants could be called in to give expert advice on special situations.

[1]PROGRAM OPERATION

12. Besides the normal operation, maintenance, and management phases of an on-going program, a sound public information program is required.

13. Management of the recreation program has to be coordinated with the other resource programs in the desert.

14. Operation and maintenance of recreation facilities is one of the more pressing problems facing government agencies today.

Benefits

The benefits to be realized if the recommendations of the California Desert Study are put in effect cannot be determined in dollars and cents alone. For example, the heavy recreational use of unique geological, botanical, archaeological, and other high interest areas is resulting in destruction and deterioration of recreation resources which could result in total loss of those values for future generations.

Additional benefits would be realized through the economic impact on the southern California Desert as a result of expenditures by recreationists for goods and services.

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[1] The remaining three phases relate directly to the operation of the recreation program and are not direct planning functions. But they are part of the total system.

THE LAND RESOURCES

Land is not usually emphasized in natural resource production and utilization. But it is an important entity--particularly within the California Desert, where burgeoning populations are exerting dramatic and often unusual pressures. As a resource, land can be analyzed in terms of specific use potentials. The quality and magnitude of these uses are directly related to population--its distribution and its characteristics.

In this report, land uses are largely those uses which require implementation by the private sector, but coordinated and planned by governmental units; that is, the implementation of land uses requires title transfer, lease, permit, or tenure adjustment.

The more common land uses that have a significant impact on the Desert can be broadly categorized as: (a) urban-suburban; (b) public purposes; (c) residential; (d) commercial; (e) industrial; (f) agricultural. Land is also required to fulfill special functions of governmental units. These land requirements can be categorized as: (a) military, (b) State of California, and (c) natural resource agencies.

Further, land includes the air above the land and in all our considerations of land use and development, we must determine if air pollution will result.

Under the Bureau Planning System a comprehensive inventory and analysis of land use should be made within the Desert Area. Because of the large area, a determination should be made as to whether the 13 existing desert "planning units" of the Bureau's planning system form an adequate reference point for inventory and analysis. As an alternative, the county boundaries within the Desert Area could also be used as most economic and other data are collected on such a basis.

Under the Bureau's land "classification" program substantial progress has been made in the Desert Area as it relates to lands classified for retention in Federal ownership. In addition, other areas are presently being reviewed for classification for disposal into non-federal ownership.

The classification program is the basic first step in the long range planning processes for resource use and disposal of the public land.

A necessary part of any long-range plan for the California Desert is a provision for realty services. Such services form an essential ingredient of any land activity. Realty services in support of other resources activity include acquiring public and administrative access to public lands as needs are determined by other resource activities.

Three major services to the public are (a) making public lands available for private needs under the public land disposal laws, (b) acting on less-than-fee grant applications for public lands, and (c) determining the public lands needed for retention and disposal under the Classification and Multiple Use Act procedures, including lands needed for public purposes, whether they be in or out of federal ownership.

Northern Desert

Two counties -- San Bernardino and Kern -- have developed general land-use plans for the Desert Study Area. A third -- Inyo County -- has not progressed as far. Disposal classifications in the San Bernardino and Kern County portions of the Study Area should conform to these general plans. Because the BLM Bakersfield District personnel indicated that the area around Mojave and the Owens Valley are heavily used for recreation and other uses, we recommend that these areas be added to the California Desert Study Area.

Southern Desert

The general plan prepared by Riverside County is adequate in deciding on general land use, but is probably not comprehensive enough in deciding on individual land tract use. A tract-by-tract evaluation should precede any land disposal classification in this County. The Open Space Study prepared for the State of California, suggests that considerable acreages will be required in Riverside County for open space values. Various types of open space uses are identified in the Study and should be evaluated when considering any disposal classifications in the County. The northern Coachella Valley, for example, is considered to be a critical region where planning is now needed.

Imperial County planning lags behind that of Riverside County. Consequently, any disposal classification action should be preceded by comprehensive planning by the Bureau, as it is doubtful that the County has the resources to do the planning.

USES OF THE PUBLIC LANDS

Urban-Suburban

Urban-suburban use of desert lands includes all land uses which are common to and characteristic of urban-suburban areas, i.e., residential, commercial, industrial, and appurtenant land uses, such as roads, power lines, parks, open space areas, etc.

The Desert Study Area includes eight urban or partially urban regions: Ridgecrest, Barstow, Victorville-Apple Valley, Yucca Valley-Twentynine Palms, Needles, Blythe, Coachella Valley (Palm Springs-Indio), and Imperial Valley (Calexico-El Centro--Brawley).

Over the past 10 years, about 30,000 acres of public land have been title-transferred within or closely adjacent to urban-suburban areas. These lands were largely developed for residential use and public purpose uses such as local parks, schools, sewage treatment sites, and rubbish disposal sites. The areas served by the land transfers were Barstow, Victorville-Apple Valley, Yucca Valley-Twentynine Palms, and Coachella Valley.

The future demand for and BLM's ability to supply needed urban-suburban land has not yet been studied in detail. Areas where the majority of transfers were made in the past will probably require increasingly more transfers of urban-suburban land in the future. Any desert urban study should pay special cognizance to protection of scenic values and the need for open space land. The timing of public land disposals must relate to the intensity and density of nearby developments.

The most active area could very well be Coachella Valley which has a restricted supply of land. Growth projections indicate that nearby public lands may offer a partial solution to the problem.

In studying regional aspects of future desert urbanization, some thought should be given to the need for new communities or cities. By 1985 it may prove desirable to direct urbanization into totally undeveloped areas.

Public Purpose Uses

Public purpose uses are those which generally are provided by government and in certain instances by non-profit organizations. For the purpose of this report, these uses are considered to fall outside of urban or suburban areas. They include parks, schools, hospitals, open space areas, municipal water districts, sanitary facilities, and fire stations.

Over the past 10 years about 20,000 acres of public land have been title-transferred in the Desert Study Area for public purpose uses. The majority of these lands have been in the vicinity of populated areas. The lands have been largely developed into parks, rubbish disposal sites, and field biology centers under the auspices of various schools and universities.

Projections of future public purpose needs and land requirements are not now available, although some data were obtained in the land classification program. The present and future effect of providing large desert areas for preservation and study of ecological factors needs thorough consideration.

Additional title transfers probably will be required to supply necessary public purpose services as the desert population continues to grow; in particular, public and private needs for airports for commercial, private and recreational purposes under the Airport Leasing Act.

Residential

For the purposes of this study "residential use" is considered to include cabin sites or rural recreational retreats, particularly in the form of 1¼-to 5-acre tracts.

During the past 10 years some 50,000 acres have been set aside under the Small Tract Act for small acreage recreational homesites. And during the 1950's even greater acreages were sold. The largest concentration of Federally sold recreational homesites lies in the desert valley area extending from just east of Twentynine Palms to Victorville. Lesser concentrations are near Barstow, Palm Springs, and Ridgecrest.

As a result of the great land sales in the 1950's and early 1960's there are an estimated 120,000 unimproved, small, privately owned parcels in the Desert today. From county projections, these parcels appear to be ample to accommodate the need for rural homes over the next 50 years.

In 1960, sales of small tracts received such heavy criticism from local governmental bodies that the program was deemphasized, and today it is virtually non-existent.

The sale of small tracts resulted in fragmentation of public land in the Desert Area between Twentynine Palms and Victorville into scattered, small parcels. In these areas, periodic sales of land probably will occur, not necessarily to satisfy homesite demand but rather to eliminate the administrative burden of these parcels in public ownership.

Commercial

For the purposes of this report, "commercial" means those uses which lie beyond the limits of urban-suburban areas and which are thought generally to include restaurants, gas stations, motels, resorts, stores, airports, and other service oriented establishments, most generally catering to tourists.

As can best be estimated, few public land sales or leases in the Desert Study Area over the past 10 or even 15 years can be attributed to commercial demand. Most commercialism has developed within urbanized areas and has relied on sales of private lands.

Future commercial development beyond the sphere of existing communities will depend largely on the location of transportation routes, expansion of recreational facilities, and growth of industry, and availability of water. Some thought has already been given to future planning for commercial development of key on-off ramp sites along major freeways.

There is a lack of information and projections as to future commercial need and placement within the Desert Area.

Industrial

Industrial use in the Desert Area has in the past been largely devoted to the mining and processing of various mineral material. Some of the larger mineral operations in the Desert include the Searles Lake bed deposits at Trona, rare earth deposits at Mountain Pass, limestone deposits at Lucerne Valley, and iron deposits at Eagle Mountain.

Relatively few public-land patents have been issued under the mining laws over the past 10 years. Because of improved exploration methods, it is expected that new mineral deposits will be found and developed in the not too distant future. It is estimated, however, that mineral production areas will not exceed one-fourth of one percent of the total public land area.

Another aspect of industrial use of land is the growing need for rights-of-way to serve power lines, pipelines, highways, and communication facilities. Public land requirements for rights-of-way have doubled in the Desert Area since 1964. By 1975 the land requirements will probably have more than doubled again.

Studies have not yet been made of the industrial impact on the fragile desert environment. Such studies should be made to plan for the proper location and placement of uses requiring rights-of-ways. Rights-of-way corridors could result in land savings and economy.

Agriculture

Desert agriculture is largely confined to Coachella Valley, Imperial Valley, Palo Verde Valley, and to a lesser extent, in the Barstow, and Winterhaven areas. These areas represent only 4 percent of the total Desert Study Area.

Public lands transferred over the past 10 years under the agricultural land laws have been relatively minor. They have been largely confined to areas adjacent to developed agriculture, such as in Imperial and Palo Verde Valleys. Some agricultural transfers have also been made in remote areas such as Chuckwalla Valley.

The principal deterrent to new agricultural development is lack of water. Any new water importation to the Desert Area will likely be used for urban rather than agricultural purposes.

Numerous Federal, state, and county publications discuss the economic, water, soil, and climatic factors that deal with agricultural development in the Desert. These data have not been analyzed in total, on a regional basis, in light of any overall land management plan.

The area covered by the California Desert Study includes two hydrologic study areas: the South Lahontan and the Colorado Desert. In 1972 the South Lahontan area will begin importing water from the California Water Project, and deliveries are expected to build up to about 215,000 acre-feet by 1991. Because of pressures of expanding urban areas, however, little water will be available for agricultural uses.

Because of the costs involved, supplies to be imported to the Colorado Desert from the State Water Project will be used primarily to support the projected population growth and to improve the quality of Colorado River irrigation supplies. Thus, prospects for future agricultural development are practically nil in the Colorado Desert--even with full development of the California Water Plan.

Rights-of-Way

The principal users of rights-of-way in the California Desert are utility companies--notably, public works, telephone. pipeline, lighting road, water, gas and electricity, aviation, and development firms.

The BLM's Riverside District Office reports the number of right-of-way cases in the California Desert as follows, by year:

1963	1964	1965	1966	1967	1968	1969 to(Jan. 1)
90	90	103	143	319	308	143

The Bakersfield District Office estimates that it has averaged 10 this year for this period.

The large jump in cases between 1966 and 1967 represents emphasis being placed on review of charges for existing rights-of-way. About one-half of the totals for 1967 and 1968 are right-of-way reappraisals.

Special Uses

A principal user of public lands under Special Land Use regulations is the Department of Defense. Rather than seek withdrawals for military use, Special Land Use Permits are being used with increasing frequency. To determine the extent of this program and probable future needs, we recommend that permits granted over the past few years be reviewed. These permits should be tabulated and plotted on maps. Then, the military services should be contacted in an attempt to assess their future needs.

Withdrawal-Restoration

About 5,725,000 acres in the approximate 16 million acre Desert Study Area are presently withdrawn for various types of use. Acreage of withdrawn land by agency is:

Agency	Withdrawal (acres)
Reclamation	835,000
Military	2,900,000
National Forests	690,000
National Monuments	1,100,000
Indian (various)	200,000
Total	5,725,000

The military and reclamation withdrawals are probably the most fertile field in which to expend review efforts to determine lands suitable for restoration to the public domain or areas where other uses might be permitted. Withdrawals for these two categories total about one-third of all public lands in the BLM District.

Special Considerations

Exchanges-- There are special demands for desert land by the BLM and other Federal agencies for exchanges of land to complement Federal land acquisition programs, such as land in BLM management areas, in National Parks, National Monuments, National Seashores, and National Forests.

The extent of a land exchange program necessary to support acquisition needs of other resource activities can be determined only after the individual activities identify their requirements. However, an estimate of the immediate recreation program needs based on the California Desert Study could be prepared if a Recreation Plan is adopted.

A different exchange program, not directly related to Bureau resource activities, will be required to provide a land base for exchanges with other Federal agencies. The California Desert Study estimates that about 10 percent of the public land in the Desert Study Area will be classified for title transfer purposes by 1970. If this is the case, a good portion of this acreage will probably be classified for exchange purposes to aid other Federal programs. Of the approximate 1,000,000 acres potentially suitable for disposal in the Desert Study Area, probably anywhere from 100,000 to 300,000 acres might satisfy exchange proponents.

Military-- Among the governmental units having special requirements for public lands, the military services have probably exerted the heaviest impact on desert land utilization. Within the study area are six major military reservations totaling nearly 3 million acres.

Because of public sentiment, it is not likely that additional acreages will be withdrawn or acquired for military purposes. Instead, land outside and adjacent to military reservations probably will be used for any testing of long-range or special ordnance devices. Use of land for this purpose has been authorized in the past by special permit on a temporary basis. It is expected that future authorizations will also be by permit.

Projected military land requirements have not been inventoried by reservation or for the total desert area. The extent of land use conflicts should be determined as well as whether or not acreage economies can be effected.

State of California -- The State of California has two broad land acquisition programs which from time to time affect the Desert Area:

(1) public lands which are Federal obligations to the State, and,

(2) public lands (generally under the Recreation and Public Purposes Act) for State Recreation or public purposes facilities or areas.

The Federal obligations to the State total about 93,000 acres. Seventeen thousand acres can be transferred under indemnity selection statutes. The remaining lands are unsurveyed school sections (sections 16 and 36) which will be transferred to the State upon survey. It is not expected that all this acreage will be within the Desert Area.

In addition, the State has thousands of acres of school lands within military reservations that it wishes to sell to the Federal Government or exchange for public land of equal value outside the reservations.

The second acquisition program involves large desert areas which the State has expressed serious interest in acquiring for recreational, scientific or historical purposes.

The State of California and its land programs could have a sizable impact on the California Desert. The full extent of this program needs current review, particularly in terms of future land requirements and possible conflict with other uses.

Air Resources

The present climate of the desert is an attraction for many people during certain parts of the year--year round, relative lack of air pollution, low humidity and low pollen concentrations.

As the population of the desert increases, the air pollution will increase--slowly if there are controls, quickly if controls are weak or lacking.

A large population or a high enough level of activity on the desert could cause climatic changes with wide effects. At the present time it cannot be accurately predicted if this change would be for the better or for the worse.

The sparse population and excellent dispersion capacity of the atmosphere makes the desert an attractive site for future location of air polluting industries. The effects on the desert ecology, however, are unstudied. At present, no policy exists to guide state and local government in decisions on desert land use.

PROTECTION

How much is a human life worth? Probably not very much in the California Desert. Out in the vast reaches of this arid land, the visitor pretty much has to fend for himself. An adequate system to protect lives and property is woefully lacking.

To provide for the safety and welfare of visitors in the Desert and to protect desert resources and property from damage or destruction, an adequate system of protection deserves top priority. Damage to people, resources, and property in terms of dollar loss is not known but is substantial and is increasing as the number of desert visitors increases. Irreplaceable resources such as petroglyphs, archaeological finds, and historical sites are being damaged or destroyed. Even more serious is the injury or death of a desert visitor. The highest penalty of inaction is a preventable death.

Unless the Desert traveler knows about the potential hazards, his visit can be disillusioning--even perilous. He should know that roads off the main highway are generally in poor condition and improperly maintained. Service stations are few and far between. Water is scarce. Communication is poor. Back roads are rarely if ever patrolled. A stalled vehicle can mean disaster. Flash floods swirling through narrow mountain canyons endanger the unwary. Other hazards include mining shafts and excavations, abandoned structures, and polluted water. Because of these hazards the Federal government can expect more $500,000 tort claims similar to the suit now pending in which a girl suffered injury from a fall into a mining shaft.

Getting lost in the Desert isn't uncommon. Each week some group or agency is called upon to conduct at least one search-and- rescue mission.

And then there is the people problem--the few visitors who disregard the safety and welfare of others, who prey upon, disturb, and victimize other visitors. Contemptuous of the Desert's natural beauty, priceless, scientific, educational, and historical features, they harass visitors, shoot garbage cans and signs, burn fan palm trees, plink gas pipelines and power transmission line insulators, rustle cattle, smuggle, trespass on decorative stones, blow up campground outhouses, paint rocks, and commit other forms of vandalism, larceny, and assaults. As a consequence of these acts, some visitors are injured by falls, vehicle collisions, and other accidents. And a few may die.

The actual number and types of offenses committed in the Desert are not known. The Bureau has few observers and does not systematically maintain records. The general public often fails to report even major crimes. On the basis of records from Joshua Tree National Monument, BLM observations, and State law enforcement officers' statements, an estimated 500 major crimes and 1,300 lesser offenses were committed in the Desert Area in 1968, or about one offense per 1,000 visitor-days.

Without an adequate protection system, a desert management program will be largely ineffective. Visitors need to be educated about the wise use of desert resources, and about how they can protect themselves. Cooperation, persuasion, and education, are the key elements to any such program. And when they fail, it is necessary to rely on law enforcement.

This report describes existing protection in and around the Desert. In analyzing alternatives, the apparent inventory and planning needs for recreation protective services in the Desert are developed. Three levels of management are considered: (a) present level, with practically no recreation development, (b) level in which recreation is developed to handle critical interim needs, and (c) level envisioned in "The California Desert Study".

PROTECTION SYSTEMS COMPARED

Besides the Bureau, two other Federal agencies have major responsibilities for land next to or within the California Desert. To measure the Bureau's protection of people and resources in the Desert, the protective systems of the U.S. Forest Service and of the U.S. National Park Service are described and compared.

Forest Service

Two areas make up the San Bernardino National Forest: 250,000-acre San Jacinto Mountains, and the 365,000-acre San Bernardino Mountains. Visitors throng to the Forests throughout the year, but most extensively during the summer until after Labor Day. They have access to a visitor center, 73 campgrounds, 15 picnic areas, 38 organization camps, a swimming area, 8 lodges and resorts, and 6 winter sports areas.

Recreationists spent about 6 million visitor-days at the San Bernardino National Forest in 1968. Visitors are increasing in number at the rate of 5 to 6 percent per annum. Many recreation residents live in 1,700 cabins located on 46 USFS land tracts. One-day capacity is about 47,000, and will increase to about 52,500 when the Cedar Springs Dam is constructed and developed.

Traffic control within the Forest is a major problem aptly handled by the 13 resident California Highway Patrol Officers. During summer, up to 18 officers are on duty on the Forest. Their prime duty is traffic law enforcement. They cooperate fully with the Forest Service and county sheriffs and are in direct communication with them.

To uphold State, county and local ordinances within the Forest boundary, the Riverside County Sheriff has deputies at Idyllwild in the San Jacinto Mountain area and the San Bernardino County Sheriff has deputies at Lake Arrowhead and Big Bear Lake in the San Bernardino Mountain area. Lake Arrowhead is protected by contract, and besides regular protection responsibilities, the sheriff provides boat patrol and rescue services.

Law enforcement responsibilities on the San Bernardino National Forest are held by the highway patrol officers and sheriff's deputies and by 45 USFS officers--30 Fire Prevention Technicians and 15 in the recreation field. Some of these Forest Service employees have peace officer appointments under State Law, but none carries guns. And all are discouraged from making arrests even though authorized to do so. Law violations include smoking or building campfires in the wrong places, entry into fire closed areas, camping without paying day use fees, and using chain saw and bulldozer equipment improperly.

Though not encouraged to do so, Forest Officers are authorized to arrest, without warrant, any person TAKEN IN THE ACT of violating the laws or regulations relating to the National Forests. Furthermore, if an officer observes a violation of a Federal Law or regulation constituting a felony or misdemeanor, he can take the offender into custody without obtaining a warrant--if this can safely be done. Such an offender must be taken without unnecessary delay to the nearest U.S. Commissioner for arraignment.

In spite of year-round heavy recreation use of the San Bernardino National Forest, protection problems are adroitly handled because of the joint State and Federal protection system. Law enforcement personnel function as a team, are well coordinated, and have the full support of the local judges and U.S. Commissioners.

National Park Service

The 557,000-acre Joshua Tree National Monument of the National Park Service has a somewhat different protection system than that of the San Bernardino National Forest. Rangers are the responsible law enforcement officers. The California Highway Patrol, sheriff's offices, and California Division of Forestry assist only as requested.

Permanent Joshua Tree National Monument law enforcement personnel total seven: a Chief Ranger, three District Rangers, and three Park Rangers. They can arrest violators and are authorized to carry firearms. Besides law enforcement, Ranger duties include traffic management, rescue, inspection of public facilities, and safety. The California Division of Forestry assists in the suppression of fires.

Bureau of Land Management

The BLM does not have a protection system for the Desert Lands it administers. Funds, personnel, equipment, and facilities are practically non-existent. Law and regulations are inadequate. Rules and regulations are unenforceable. Inventory of hazards and resource values is yet to be done.

Scattered across the 11 million acres of desert public domain are at any one time a handful of Bureau administrators, maybe 1 per million acres. Occasionally along main highways California Highway Patrol cars pass by. Sheriff's deputies are scattered wide and far around the edges of the recreation study area. The Bureau has five completed campgrounds in the Desert Area which are maintained and protected by two part-time employees.

Bureau employees are not trained in law enforcement, make no arrests, are not authorized to carry or use firearms in performance of duty, can cite no one for Federal law or regulation violations other than by Notice of Trespass, and cannot bring petty offense violators before a U.S. Commissioner or Magistrate. Bureau employees must take violators of civil and criminal Federal laws to Federal Court through the U.S. Attorney regardless of how serious the offense. The simplest action may take a year or more to conclude. Protection coordination with local and State law enforcement offices is limited and generally by telephone.

Public land recreation rules and regulations became effective on January 18, 1969. Their purpose is to provide for protection, enhancement, and management of outdoor recreation resources and natural values and for public use of the outdoor recreation resources of the public lands. The rules and regulations are limited. Legislative authority is required for enforcement. Until such legislative authority is provided, the Bureau must use cooperation, persuasion, and education to make the rules and regulations work.

State and Local Agencies

The State has concurrent legislative jurisdiction with the United States on lands administered by the Bureau in the Desert Study area. Therefore, it can enforce State and local laws and ordinances on these lands.

The County Sheriff is responsible for enforcing State and county laws and ordinances and for preserving the peace. Sheriff's Offices provide rescue service, maintain law and order, and patrol in the desert where they can. Generally, their services are limited to the desert fringes except by call. In addition to employed jailers, administrators, clerks, sworn deputies, the Sheriff has his volunteer reserves and can designate federal employees as peace officers.

California Highway Patrol is primarily concerned with the safe, proper use of the highways within the State and with providing assistance to the motoring public. In the Desert, its duties are usually performed along main highways and not in the back country.

California Division of Forestry has a number of fire guard stations west of the Desert Study Area. Fire incidence in the desert is low. By Bureau request the Division helps suppress fires on Bureau lands. Costs are reimbursed.

California Department of Fish and Game enforce State laws relating to the protection of fish and game. Its wardens have the powers of a peace officer to make arrests for the violation of state laws. And they are deputized by the U.S. Fish and Wildlife Service to enforce Federal Fish and Wildlife laws.

PROPOSAL

Inventory

To plan for protective services,it is necessary first of all to identify high risk areas in the Desert--areas valuable or dangerous or both to the visitor. Knowing where these high-risk areas are is vital in protection planning and in day-to-day deployment of forces to minimize risks.

The elements to be inventoried include hazards, transportation, communication; recreation facilities; water services; natural, scientific, historic, and educational values; and damage to resources.

After data are gathered, map overlays can be prepared to show the existing situation and the planned situation as related to time, i.e., a planned campground and its expected completion date. One of the prime end products of this inventory is the location of risk areas on overlays. This information permits a system of planning for minimal risk protection. And, by keeping abreast of daily risk changes, i.e., a new motorcycle event, protection forces can be deployed to minimize any additional risks.

The map overlays also reveal conflicts, duplications, planning needs, and potential problems. This knowledge, too, is of prime importance in planning protection services.

If legislation is enacted to grant to the BLM law enforcement authority, then certain district field personnel need to be trained. State peace officers and professional consultants can provide guidance in developing the protection training program.

BLM law enforcement officers,to be called Rangers, should be empowered to issue citations. Many should hold local peace officer appointments. Their duties should approximate those of the National Park Service Ranger. They should be trained and organized to handle normal search-and-rescue operations, disturbances, and disasters.

Chain of command should flow directly from the District Manager to the Chief Ranger, who has charge of the total protection program. He should be responsible for traffic management, law enforcement, fire protection, and protection support.

A Ranger's duties should include fire control, visitor protection, natural resource management, search-and-rescue, inspection of public facilities and safety. Generally,Rangers should be college graduates in resource management or educated in a 2-year college with a major in police science and practical law enforcement experience.

Transportation facilities available to the Ranger staff should include an airstrip with lights and directional vane located at each Way Station and Bureau-owned aircraft for search-and-rescue, patrol, emergency personnel transport, fire spotting, and management.

The Bureau should prepare emergency plans to handle major incidents, i.e., riots, natural disasters, airplane crashes, floods, and major rescue efforts when multiple deaths and injuries occur. Local, state and Federal responsibilities are worked out in advance.

Other protective measures that the Bureau should take include registration and signing. A voluntary registration and check-in system at each Way Station and Desert Center should help the Ranger keep track of visitors. Electronic traffic counters should be located at strategic road intersections in the Desert to assist Rangers in determining where people are going. Hazards are signed. Most important, Desert roads are numbered and signed at intersections. This enables proper road identification on desert maps.

Information handouts should be developed. They should cover such subjects as "Rules for Dune Buggy Drivers in the Imperial Sand Hills," "Motorcycle Routes of the Desert," and "Cima Dome Wildlife." They are also a means of determining where visitors are going, and of warning them of potential hazards.

Planning

Protection planning to the present has been negligible.

Critical interim planning is aimed at completing a protection inventory eliminating hazards, developing policy and objectives in protection and safety, determining organization and duties of personnel, obtaining enabling legislation laws and regulations, publishing procedural manuals and guidelines, and training personnel. At the same time that inventory and planning are taking place, the Bureau will need to continue to protect desert resources, visitors, and employees with the means it has.

Hazard reduction can be handled by contract for such actions as fences, fill or block drifts, excavations and shafts, repair or sign road hazards, install road guard rails, trail and road warning signs, water hazard signs, fill or cap wells, and destroying hazardous abandoned structures.

A comprehensive plan for the public lands in the California Desert should consider a protection system developed at some ultimate level of visitor population. Considered here is the 50-million visitor-day level envisioned by the 1968 California Desert Study. This study sets forth five recommendations on protection:

1. Uses that detract from the appearance of the Desert should be regulated.

2. The recreation resources should be protected.

3. Public contact and surveillance should be by BLM Desert Rangers on a day-to-day basis.

4. Visitor services should be provided at a Desert Center and strategically located Way Stations.

5. The Desert should be kept clean.

The protection system that may best meet these objectives is based on a combination of systems used by the San Bernardino National Forest and by the Joshua Tree National Monument. Like the practices of the U.S. Forest Service, law enforcement should be a coordinated team effort by local, state, and Federal officers.

Under the district manager, a protection branch is established. The protection organization is planned by BLM with guidance from professional protection consultants. The protection organization is developed to adequately protect desert visitors and resources and expands with recreation feature identification and facility development.

THE COMMUNICATION PROBLEM

An efficient communication system is at the heart of any management system. It becomes increasingly mandatory if the elements of safety, public welfare, and damage potential are present. In the California Desert, all of the following considerations are present and require rapid, dependable means of of communication:

- Vast expanses of terrain are involved.
- The area is generally accessible to the using public, and visitors range widely.
- Many hazards, natural and man-made, exist.
- Except in limited areas, there are no means of communication.
- The number of management personnel is small.
- Opportunities for crime and material damage to irreplaceable resources are great.
- Climatic conditions are severe.
- Management must be keyed to rapid communication.

As the Bureau steps up the tempo of its activities in the Desert, it will increasingly become involved with the health, safety, and general welfare from 5 million to 50 million people a year. It is already charged with the management and protection of public resources.

Electronic communications are the only practical and economically attainable method of covering the California Desert. Because of the distances involved, and the configuration of the mountain ranges, a sophisticated radio network seems to be the best choice. Most of the radio communications now in operation are directed toward the major highway access routes, but they would be only of limited value to the development of a desert network. In setting up a network, other problems would have to be overcome. Power sources are not generally available. Key radio transmitter sites may be nearly inaccessible. And extreme heat may jam the equipment.

PRESSING NEEDS

The pressing need for a radio communication system is suggested by these facts:

1. At least one search and rescue mission is needed each week in areas where temperatures consistently exceed 100 degrees for 5 months each year, this situation can become an urgent matter of life and death--not only for the public--but also for Bureau employees. And we are now actively encouraging people to use the Desert.
2. Many hazards in the Desert threaten the health and safety of the visitor. They include poisonous reptiles, abandoned mine workings, cliffs, dangerous roads, flood areas, and severe storms. Should an accident occur a rapid communications system becomes critical because often minutes count in getting help at the scene.
3. Resources must be protected from destruction either from natural causes (fire, flood, etc.) or from human activity. There is a fire potential on more than 2 million acres of the Desert.
4. Public service requires fast, accurate answers to visitor's questions. For example: Are there any camp spaces in Owl Canyon? How is the road over the Cima Dome? Are the spring flowers in bloom along Lucerne Valley Road? The requests for advice, directions, assistance, and aid beyond the emergency category is already overtaxing present facilities and personnel.
5. Sanitation requirements require close coordination of the maintenance crews that can best be achieved by rapid communications. There would be no need, for instance, to send a dump truck to a lightly-used campground, or a pickup to a heavily littered area. Any litter or trash buildup cannot be tolerated for public health reasons.
6. Preliminary studies suggest that major crimes are committed at the rate of about 1 percent for every 1,500 visits. Minor crimes in the Desert include off-road vehicular violations, trespassing, destroying property.

7. Vast areas of the desert are contaminated with unexploded ordnance devices from World War II training exercises. To patrol adequately these areas, warn the using public, and perhaps rescue or aid them would necessitate a rapid means of communication.

RECOMMENDATIONS

Frequency Band

The Bureau of Land Management is now using frequencies in the 163 to 174 Mega-Hertz Band for mobile communications in all states. This band is not subject to skip interference, and should be used for base stations, mobiles, and portables in the Desert. The 25-50 Mega-Hertz Band provides greater coverage areas per base station or repeater in regions with advantageous soil conditions, but it is subject to skip interference. In most of the California Desert, the soil conditions are not advantageous for radio propagation, and the 163-174 Mega-Hertz Band will provide coverage equal to the 25-50 Mega-Hertz Band. Frequencies in the 406-420 MHz Band can be used advantageously for point-to-point operations to control the base stations.

Radio System Operation

To achieve communications throughout the California Desert with a reasonable number of fixed stations would require a substantial increase in communication efficiency over the 5- or 10-mile range of portable or mobile communications. This greater efficiency can be obtained only by using fixed stations with effective antenna heights many times greater than the 5 or 6 feet obtained with the typical mobile or portable antenna installation.

Even with the most advantageous location of fixed stations, a number of base stations with remote radio links and quite a number of repeaters will be required to obtain the needed communications.

The recommended radio system design should include some practical means of repeater selection to prevent interference produced by the simultaneous operation of two adjacent repeaters. Repeater control can be achieved by changing the channel frequency or by using a common repeater channel with tone selection of repeaters. The tone system can be implemented with audible or sub-audible pulse or continuous tones. The pulse tones can be binary or decimally coded, low or high speed. Using multiple channel frequencies for repeater control is difficult to justify with the growing shortage of channel frequencies. Any scheme is difficult to implement with personal portables. Besides being the simplest and most economical, the single-audible-pulse-tone method is probably easiest to implement in personal portable radios. Therefore, the

California Desert Communication System should be based on the repeater selection system.

Location of Radio Stations

Picking advantageous locations for the base stations and repeaters can greatly reduce the cost and complexity of a radio system. The key factor is the effective antenna height at the fixed station site. This effective height depends not only on the altitude of the site, but on how prominent the site appears to the surrounding area. An ideal site would be a lone mountain peak. But if this same peak were surrounded by other peaks, the other peaks would form a shield, reducing the effectiveness of the central peak. Mountain ranges in parallel rows, as in the eastern desert, pose a similar problem. A station on one range would cover the near faces of adjacent ranges, but the far faces of adjacent ranges would be shaded. And the range with the station would be low lengthwise of the range. To provide coverage in this mountainous terrain, stations must be closely spaced in a grid so that each mountain range is covered from more than one direction to minimize dead spots. A 40-mile grid probably would yield a reasonable approximation for estimating costs.

Riverside District.--For the Riverside District, we recommend three base stations: (a) on the north side of the San Gabriel Mountains to serve the northwest portion of the Mojave Desert; (b) east end of the San Bernardino Mountains to serve the balance of San Bernardino County to the Nevada border; and (c) the Santa Rosa Mountains on the west side of the Imperial Valley to serve the balance of the Southern portion of the Desert Study Area. Owing to the multiplicity of mountain ranges in the Desert, it will be necessary to supplement each of the three Base Stations with about six repeaters. While it might be possible to reach the San Gabriel and Santa Rose Base Stations with single path 400 MHz links from the present Riverside District Office locations, it would not seem possible to reach a base station on the east end of the San Bernardino Mountains with a single path 400 MHz link unless the base station was located on the 10,000 ft. ridge in the San Bernardino National Forest Wilderness Area.

Locating a base station in a Wilderness Area would not seem wise due to the opposition likely to be encountered and the difficulty maintenance would pose with only helicopter or pack animal access.

Bakersfield District.--A single base station already planned near Chimney Peak in the Sierra Nevada could be supplemented with about four repeaters to serve the north end of the Desert Study Area. This base would be served by a two-path 400-MHz link from the Bakersfield District Office.

Of the recommended equipment, two of the 400 MHz link sets have been ordered. The base station, a repeater, and the other two 400 MHz link sets are programed for future construction. About three remaining repeaters need to be added to this to cover the Desert Study Area. Additional equipment would be needed to complete the District coverage outside the Desert Study Area in the Riverside District and possibly in the Bakersfield District.

System Design Procedure

The sequence of actions in designing a radio system for the Desert would include:

1. Prepare tentative system drawing showing area of coverage, frequencies desired, and mode of system operation for Washington Office review.

2. Revise system drawing to reflect choices after test, evaluation, and final selection of sites. Prepare profiles and submit to Washington Office for review and frequency assignments.

3. Design necessary antennas, support towers or poles, and building, housing, or vault for equipment at each site. Include lightning protection as needed. Include power wiring and if commercial power is not available, design power system.

4. Design electronic equipment for each site, matching equipment to available power supply at each site.

5. Design access vehicle trails or improvements to existing roads as needed at each site. Savings could be realized by coordination with recreation site road program and other road programs.

Radio Site Selection Procedure

A suggested procedure for the selection of the base stations, control link and repeater sites would involve:

1. Inventory all communication sites in the Desert Study Area, together with the adjacent area overlooking the Study Area and control-link paths from the Riverside and Bakersfield District Offices to possible base station sites.

2. From relief maps, pick the present communication sites most suitable for BLM use. If available, several alternates should be selected for each point where a BLM station is needed. Also pick likely sites for areas where there are not

any sites in use, and pick likely unused alternates for areas where the present communication sites appear inadequate or do not provide alternates.

3. From detailed contour maps and aerial photographs (where available), evaluate all sites for present access and cost of improving access. This process should still yield several alternates near each point where a site is desired. The selection should be coordinated with the recreation and other road programs.

4. Check status of all remaining sites and obtain permission to test from land owners or land managers for sites other than Public Domain.

5. Test all sites by using a portable base station at each site and four vehicles equipped with portable radios and external antennas.

6. Evaluate and select final sites on Public Domain and other Government land where occupancy can be assured. Negotiate for occupancy of other sites on private land or Government land subject to restrictions.

THE TRANSPORTATION PROBLEM

In the California Desert, the transportation network has grown from a few native trails to a proliferation of freeways, highways, and byways that blanket the some 16 million acres. At first glance it may appear that this system adequately provides for the needs of the area, but closer study reveals many deficiencies in the location and construction of roads.

1. In some cases many years of use on an unstabilized surface has resulted in a loss of several feet of material. The road becomes a trench, resulting in unusual maintenance and of greatly lessened value as a recreational route.

2. Infrequent maintenance, with the resulting poor riding surface, has led to the development of parallel trails. At times three or four trails will develop, with the rider selecting the most comfortable. The resulting scar on the land detracts greatly from the natural beauty.

3. The existing desert roads generally take the shortest and easiest route between two points. While this is necessary on major routes, it is neither desirable nor necessary on the bulk of the system.

4. Unwise use of the land has destroyed much of the natural beauty of some sections of otherwise scenic routes. Some routes have more than their fair share of "Small Tract" architecture and power lines, and some rerouting will be necessary to regain a desirable environment.

5. Existing transportation planning by the state, counties, and Bureau of Land Management has been done without the benefit of detailed resource inventory and planning. Without this detailed planning there is no assurance that a facility constructed today provides adequate protection for the resource or that it will adequately serve the resource in the future.

6. There is no BLM coordinated approach to the establishment of scenic highways and parkways. At least two state agencies, four of the counties in the study area, and one inter-county group have made recommendations for various types of scenic routes. The only designated scenic routes now within the study area are a short section of State Route 190 entirely within Death Valley National Monument, Highway 15 from Dunn to Baker with the section between Barstow and Dunn being proposed, and

a shorter section of State Route 38 within the San Bernardino National Forest. All roads within the Death Valley and Joshua Tree National Monuments are managed as scenic routes, but the total mileage is limited.

Existing Bureau of Land Management instructions do not adequately provide for transportation planning of the scope required in this study. What is needed is the orderly development of a transportation plan for the California Desert.

PLANNING

The Bureau of Land Management is the principal landowner and manager in the California Desert. The location and construction of transportation facilities will have a heavy impact on the management of desert lands. Therefore, the Bureau should assume a more active role in transportation planning and coordination for the Study Area.

The general objective of transportation planning is to establish a system capable of accommodating all travel in an orderly,safe, efficient and economical manner. Three conditions influence this objective: (a) owing to the rapid population expansion in Southern California, there has been an unprecedented demand for a transportation network within the Desert; (b) there is a great need for coordination and cooperation to insure wise development of the desert among governmental units engaged in planning; (c) and there is a continuing demand for obtaining the most benefit from each dollar expended.

PLANNING SEQUENCE

A logical sequence of planning steps should be established for the California Desert. The first step will be to select the classification system that will be necessary.

Highways

Functional System -- The most important method of classification for planning purposes is the functional system. In this system each component is assigned a class based on the expected use of the road. The freeway, for example, serves only through traffic. The primary system serves through traffic traveling inter-city or inter-county. The secondary system consists mainly of county roads serving smaller communities and adjacent areas. In the Desert they will provide the primary means of dispersing the recreation traffic. The feeder system will comprise the largest segment of the desert highway system. In addition to providing access to the recreation areas, it should become a recreation destination in itself. Within the category of land access are included short access roads to interpretive sites, recreation sites, and service roads.

Airfields

Airfields consist of airports, heliports, and helispots. The Federal Aviation Administration has developed a functional classification, based on expected use. At the time detailed planning is started, this classification should be studied and adapted to BLM needs.

PLANNING SURVEYS

The next planning step is to investigate all existing planning surveys to provide detailed, current information about the transportation system.

Inventory -- An inventory is made to obtain sufficient data to permit drafting of maps; the compilation of statistics on the mileage or number of the several types of facilities, the kinds of structures and other data; the evaluation of needs by allowing comparison with a standard; and a periodic evaluation of the adequacy of any component of the sytem.

In addition to the physical features of the roadway itself, some classification system for the cultural features adjacent to the roadway should be included. This could include such items as degree of urbanization, dump grounds, intrusion of power lines, scenic vistas, and other factors which would add or detract from natural beauty.

Another category in the inventory should be critical features. This would include any features which may be hazardous to the traveler or which are outside the general design of the facility. An example would be a sudden sharp curve after many miles of flatter curves.

As part of the inventory process, a separate program to retrace and mark the historic trails of the desert should be established. When routes are determined, detailed maps should be prepared for public use.

Maps -- A series of maps for general distribution and charts and maps for special planning purposes will be needed. Both the state and counties maintain various maps in connection with their inventories which can be adapted to this use.

Traffic Studies -- Two types of traffic studies should be extended to the desert transportation system: (a) volume counts provide information on volumes of traffic using a particular facility and can be established to provide nearly any desired interval, and (b) origin-destination studies of the origin and destination which are basic to other activities in the Desert.

Determination of Needs

From results of traffic and other resource studies, projections of amounts of traffic and the assignment of this traffic to the various components of the system should be made. At this stage of planning, an inventory of potential conflicts is needed. Many resources could be harmed by an improperly established road or trail, and these should be identified and located on maps so that they may be avoided.

The next major planning step is the development of a transportation plan to satisfy the future needs of the area. Because of the need to carry large volumes of traffic in the safest manner possible, it is possible to vary the routes and standards of the freeway and primary system only within very narrow limits. Protection of the roadside environment is important. An investigation of known future routes across BLM lands should be made and proper protection given these routes as soon as possible. The greatest need in desert highway planning includes the secondary and feeder classifications.

Any vacant public lands now may be appropriated for public roads under authority of R.S. 2477 without notification or application to the United States Government. These kinds of public land appropriations pose a serious problem to sound land management.

The BLM should undertake appropriate classification actions for those public lands that will remain in federal ownership so that road construction on them would require BLM approval of route location and standards. Only with this type of control can a comprehensive transportation plan for public lands in the desert be effective.

The feeder system will be the largest component of the system. The purpose of this system is to provide a pleasurable driving experience. To this end, the location and design must be most carefully controlled. The most scenic and varied terrain available should be utilized for this system. Care must be taken, however, to avoid destruction of the resources which make the location valuable. The road location must be sensitive to the environment. And the road should be well designed.

Future demand for trails is difficult to predict. The immediate need for a "catch-up" program in the area of competitive sport motorcycling is evident and should be given high priority. Beyond that much more data are needed and can be developed as part of the Phase III comprehensive planning effort.

Other Systems -- Superimposed upon the functional system are several other systems established for administrative purposes. Administrative system is based on governmental responsibility for construction and maintenance. The Federal-aid system was established solely for the purpose of distributing Federal funds and the raising of design and construction standards. The National Interstate Highway System was established to provide continuity between the various state systems. And the United States Highway System was established to provide for numbering continuity from state to state.

Trails

A trail system in the Desert appears to satisfy two general demands. One is the desire to ride or walk for pleasure, and the other is the desire to compete against the desert environment. The demand for facilities is difficult to estimate, and a thorough study is needed.

The following classification system for Desert trails is suggested.

General Purpose Riding or Hiking Trails -- This system would be constructed to allow passage on foot or by two-wheel vehicle. Grades would be gentle and routes would be selected to take advantage of the natural beauty of the area. This system would be developed in the more scenic portions of the Desert, usually in the mountains, and would generally be destination in itself. Natural or developed water supplies would be a desirable feature of this system.

General Purpose Vehicle Trails -- This system would provide selected cross-country routes for off-road vehicle use. Routes would be selected for varied terrain and minimum impact on soil and vegetative resources. This system would provide a retreat from the main transportation routes. Since the purpose of this system is pleasure driving, routes should not be too challenging. Desert washes would be used extensively.

Special Purpose Hiking Trails -- This system includes nature trails, access trails to interpretive sites, etc. They would be constructed for foot traffic, and vehicular traffic would be prohibited.

Special Purpose Vehicle Trails -- Because of the growing interest in competition sport motorcycling in the Desert, it is evident that a system of motorcycle trails is necessary.

Another type of special-purpose trail is intended to provide for maximum testing of the driver and his equipment. Separate facilities for two-wheel and four-wheel vehicles would be required, although two-wheel vehicles would be expected on the other routes.

The future need for airfields is poorly defined. As management becomes more intensive, it is expected that a need for Bureau of Land Management airfields will develop. The Federal Aviation Administration has a functional classification system and recommended minimum standards available, and its advisory services should be utilized.

PROGRAMING

The final step in the planning process is programing, which consists of determining priorities and planning an action plan. Both of these steps are keyed directly to the needs of users -- especially users of the recreation resource. Construction and maintenance responsibilities for the various components of the transportation system should be determined early in the programing stage. Construction plans should include surface stabilization whenever possible so that future maintenance requirements do not become excessive. The next planning stage should include a determination of the feasibility and extent of Bureau of Land Management road maintenance in the Desert Area.

An adequately staffed and funded engineering organization should be established for the Desert Study Area. This organization would be under the guidance of a supervisory engineer and would provide all of the engineering services required for the detailed planning phase and would provide a nucleus for the development phase.

The resource area boundaries would be used to delineate responsibilities and it is assumed that the study area within the Bakersfield District would be serviced from the appropriate Riverside District area headquarters. The planning organization could be established in two sequences: the first sequence would cover a 1-year period, and the second sequence, a 2-year period.

ECONOMIC ANALYSIS

Long-run and short-run management plans for the California Desert must be economically sound if we are to maximize benefits from the Desert's resources. Economic evaluation is also necessary in selecting best alternatives for meeting objectives within budget limitations, and for resolving conflicts among uses of these resources.

This report (a) summarizes the socio-economic factors that affect the California Desert, (b) identifies benefits of existing and proposed programs, and losses due to delayed action or total inactivity, and (c) outlines the need for economic studies to be undertaken in the next phase of the Desert Study, which will establish a factual profile of the economic resources of the California Desert, including a measurement of their availability and the present and potential demands for or uses of these resources.

Socio-Economic Factors

About 60 to 65 percent of the people in California live in the area directly west of the California Desert. Demands for use of public lands for recreational pursuits are directly traceable to the population pressures and to the economic growth of the entire Southern California area.

Population--Rapid population increases in the San Diego and Los Angeles Areas began during World War II and continued into the 1960's. Recent trends, however, indicate a decrease in the rate of population growth. This trend may be attributed to air and land pollution problems, population concentration, and to some extent--lack of land for industrial expansion. Because of land patterns, the only migration can be toward the Desert.

Projection of population trends in the 14-county Southern California area suggests a 40 percent increase by 1975 and nearly 80 percent increase by 1980 (tables 1,2).

Income in Southern California is generally high, ranking among the top in the nation. Personal income in the 14-county area made up about 63 percent of the State's total income. The greatest increases in income were found in the counties which moved from an agrarian economy to an industrial economy.

The number of poverty stricken in the Southern California area is low--as is the number of very wealthy. The bulk of the population enjoys a middle income--neither substantially higher nor lower than other major metropolitan regions of the United States.

Per capita personal income ranges from $2,111 in San Bernardino County to $3,028 in Los Angeles. For the 14-county area the per capita rate is $2,748 (table 3).

Employment-- Growth in employment in the California Desert has paralleled the increase in population since World War II. But there have been some declines, for example, in agricultural employment. Major increases have occurred in manufacturing, services, trade, transportation,and government.

Manufacturing (conversion) has the single largest employment impact in the region, while that of the extractive sector is extremely low--except in Imperial and Riverside Counties (table 4). Mining employs few people, but this condition fails to reflect the potential of the industry.

Unemployment rates fluctuate noticeably. Most recent published data show unemployment in the Los Angeles Area is about 4.5 percent of a 3,064,900-civilian labor force compared to 6.2 percent unemployment of a labor force of 340,000 in the San Bernardino-Riverside-Ontario Area. These figures reflect the inherent tendency for higher unemployment in the agriculture sector (table 5).

Leisure Time--Recreational demands of all types, but especially outdoor activity, increase directly as leisure time and disposable income increase. Expenditures for recreational activities are at their peak. Present rate of spending for recreation is approximately 6 percent of personal disposable income. Personal disposable income currently exceeds $2,000 per capita nationwide. In Southern California, it can be assumed that the level is somewhat higher. Under present conditions, an increase of 36 percent above the present level may be expected by 1980, and possibly a rate of 100 percent or even more by the year 2000.

Small changes in leisure time can inflict excessive impact upon demands and use patterns. Leisure time available in the heavily populated Southern California Area will experience an 84 percent increase by 1980 over what it was in 1960. Presently, weekends and holidays account for over 40 percent of the leisure time. Vacation periods account for 6 to 8 percent of free time.

A most important demand change which will have an immediate rather than gradual impact in preparing economic projections for recreational needs is the national restructuring of holidays. Public Law 90-63, dated June 23, 1968, increases the number of legal holidays to nine. As of January 1, 1971, the law provides for five, three-day holiday weekends, annually, whereas heretofore only Labor Day consistently assured an extended weekend.

In preparing recreational programs for Phase III of the Desert Study, economists and planners should incorporate these holiday changes into projected demands. Seasonal use of desert facilities will be directly affected by at least three of these holidays and probably all of them.

Other factors, which are not as imminent, but must be considered in future planning, are the 4-day work week and trends toward earlier retirement age. The advent of the 4-day work week may reach fruition during the 1970's. Desert recreation demands would then increase beyond any capacity now considered.

Another economic indicator attributable to the rapid increase of outdoor recreation is sales trends in motor vehicles. About 80 percent of recent light-truck sales have been of the custom-made vehicles or pickup models adaptable to camper components. About 70 percent of all light trucks are now used for personal transportation and recreation. Major automobile manufacturers estimate the pick-up camper market will increase 58 percent by 1980.

Known Economic Benefits

Recreation--Detailed data are not now available to determine expenditures of individual recreationists for desert activities, but estimates can be made from similar recreation uses. Expenditures will vary with types of activities and length of visits. Because of the lack of definitive values for outdoor recreation, Senate Document #97 assigned values for Government agencies to use. The values are intended to measure the amount users would be willing to pay if payment were required. Values range from (1) \$.50 per visitor-day for undeveloped recreational facilities (usually access only); (2) \$1.00 per visitor-day for partially developed but limited basic facilities; (3) \$1.50 per visitor-day for fully developed facilities, including parking, water, camping sites, picnic tables; and (4) specialized recreational day values ranging from \$2.00 to \$6.00 for activities where opportunities are generally limited, intensity of use is low, and personal expenses are normally large. Current recreation use in the desert exceeds 5 million visitor days annually.

If we assume that recreationists using the desert lands of California average \$6.00 per person per day, roughly \$30 million in expenditures could be attributed directly to desert recreation for 1968. Total impact of this expenditure would be further increased by the multiplier impact of our economic system. If the anticipated 50 million visitor-days projected for the year 2000 are achieved, it is obvious that the economic impact will be substantial.

Economic impact on local communities resulting from recreational expenditures greatly exceeds those stipulated under Senate Document #97. Such impact on communities within and outside the Desert Area cannot be measured solely by total expenditures from the recreationists. Local income, employment, and sales are all influenced by recreation expenditures. And these measures of the local economy tend to move together; that is, as sales rise, value added and employment generated also tend to rise.

A result of the expenditure pattern is an economic multiplier process. Multipliers vary from community to community and will vary also with size of the impact area, and with type of consumer and recreation expenditure. Formulas are available to calculate the multiplier impact upon a given community, but data for the desert regions are insufficient to provide a definitive indicator. But data for such desert communities as Barstow and Needles suggest that for every dollar spent by the recreationist stimulates from $1.35 to $1.75 in additional spending. Multipliers for specific purchases may run from $1.25 to $1.30 for gasoline station purchases and approximately $1.80 to $1.95 for food and beverages.

Local impact of expenditures do not reflect multiple effects resulting from purchases of motorcycles, dune buggies, and other such equipment. Production of these items result in increased job and income for larger trade centers. Even though these effects are far more difficult to determine, it can readily be seen that increased recreational activity in the Desert will have significant economic impact.

Minerals--The most important economic impact upon a local community, resulting from mining is employment. Only minor machinery and equipment sales result locally, especially in Southern California Area. Most large equipment is sold in metropolitan Los Angeles.

Mining employment in the Desert Region is small compared to other economic sectors. Within the 5-county Desert Area, employment for the mining industry totaled 3,896 in 1963 (the most recent actual census data). Mining payroll for the period was $26,309,000. For the total economy of the desert impact area, including Los Angeles' Metropolitan Area and San Diego, employment for the mining industry was 14,702. The payroll amounted to $111,493,000. Under present conditions, employment for the mining industry within the Desert can be expected to increase no more than 5 to 10 percent by 1980. Technical advances in mining methods will allow sizable increases in production, but with only minor increases in employment.

Total mineral sales have increased by about 24 percent during the period 1963 through 1967. Value of mineral production for 1963 was $283,123,000 and for 1967 it increased to $348,843,000.

Sand and gravel represented the largest single mineral sales for the combined counties (table 6). Rapid increases in Southern California's building and highway construction account for the steady increased need for sand and gravel.

How much of the mineral production and mining can be attributed to public lands is unknown. Income figures, by land ownership, reflect spurious data because of methods for obtaining property. Land patented by various homestead acts conveyed different interests to settlers. The Homestead Act of 1862 conveyed fee title; later acts reserved coal and associated minerals. The Stock Raising Homestead Act of 1916 reserved all minerals to the United States.

Sand and gravel is the only ubiquitous mineral in the desert. But it is a source of conflict in recreation plans because it is an open-pit, extractive, heavily demanded resource. Detailed inventory of known deposits, both as to location and reserves, should be undertaken early in a phase III Desert Study.

Value of sand and gravel sales for 1967 was $37,408,000 for the 6-county Desert Area. It may be expected that this value could increase to between $80,000,000 to 100,000,000 by 1980. Amount of this mineral taken from public land is somewhat nebulus. Total value of recorded free use and sales of sand and gravel, stone, and highway material from the BLM was $151,921 for 1968. It is highly unlikely, however, that this figure reflects the true amount of these minerals taken from public lands.

Sand and gravel located on public land offers even greater future potential. Demand is directly influenced by building and construction industries. Any impact upon employment in the mineral industry will be slight because great changes in demand will result in only minor increases in labor owing to the degree of mechanization.

Range Forage--Use of the California Desert for livestock feed ranges between 135,000 to 180,000 AUM's, annually, covered by 65 leases on Section 15 lands and 30 licenses on Section 3 lands. Actual value realized by the BLM for this forage has averaged about $58,000 annually. Increased rates will eventually bring the income to approximately $215,000 for the same amount of forage. Range condition, precipitation, and other factors lack promise of substantially increasing the amount of forage to be provided.

Feed requirements for the livestock population in the desert region as of January 1, 1968, totaled 12,037,000 AUM's. Total feed requirements for the 25,000 cattle and 128,000 sheep amounts to 607,000 AUM's. When desert conditions are favorable, BLM lands furnish nearly 29 percent of the feed required for the animals permitted, and 1.4 percent of feed requirements for all livestock in the desert counties.

During the past 15 years, cattle numbers have increased steadily while sheep numbers have continued to decrease noticeably. These changes follow the national trend (table 7). The livestock industry can be expected to increase no more than 2 to 3 percent annually.

Dependency upon BLM forage in the desert must be considered small and unreliable. Variations in annual amounts of forage makes it difficult for operators to program forage needs in advance. Increase in grazing fees may further change patterns of use on the desert grazing lands. Conceivably, dependency may decrease further.

Wildlife--The two types of people who have the most interest in wildlife are the hunter and the naturalist (including sightseer). Insufficient data are available to comment realistically on the economic impact of wildlife. The Phase I Desert Study indicates that approximately 530,000 Gambel's quail were taken during 120,000 hunter-days in 1963. If we use the values established in Senate Document #97, a small-game hunter can be expected to spend between $5 and $6 per hunter-day. Therefore, an impact on the local economy of $975,000 to $1,000,000 is realized. Recent inventory by the Bureau of Sport Fisheries and Wildlife estimates 1,900,000 wildlife related visits, excluding fishing, to the California Desert, annually. The value of these wildlife visits if the visitor were required to pay for the experience is estimated at $5,000,000. Total expenditures related to the wildlife visits in the Desert range from $11 million to $30 million annually. Although the percent of money spent in the desert communities is unknown, the magnitude of total expenditures still has considerable impact on the desert's economy. The local economic multiplier for small game hunting in the Desert is estimated to be about the same as for recreation, or $1.50 to $1.60 for every dollar spent.

The estimate that number of hunters for game bird will increase 100 percent by 1980 seems realistic--provided bird population increases proportionately. All types of hunting will probably increase, but as recreation in the Desert becomes more popular, the naturalist's interest in wildlife may grow even more rapidly.

Land--In addition to other amenities, the California Desert offers potential for irrigated agricultural use. Large areas of potentially irrigable lands exist in the Mojave Desert near Victorville, Barstow, Lucerne Valley, Yucca Valley, and the Coachella Valley. Irrigated acreages of the Imperial Valley can be expected to increase if water is available. The amount of irrigated acreage could be expected to increase over the 1960 figure by nearly 70 percent or 2 million acres.

Water from northern California delivered to the Desert to recharge underground reservoirs as well as continued water developments along the Colorado River, may provide additional water for use.

If so, a combination of long growing seasons, growing multiple crops annually, nearness of markets, and large land areas will enhance the value of some desert lands for agriculture.

In addition to the potential for irrigated agriculture, desert lands near existing communities are valuable for increased urban-suburban development. Expansion of industry in Southern California may also result in new communities being carved out of the desert lands.

Future Economic Studies

Vital as it is for the Bureau to develop quickly a comprehensive desert management plan, it cannot do so without collecting information about the location of, amount of, and demand for desert resources and their uses. It needs to study the problem of competing uses and of resource conflicts resulting from policy issues. In developing a desert management plan, the Bureau must make certain assumptions. Paramount among these are that demands and changes will be evolutionary rather than radical departures or drastic shifts from existing economic and social trends. Planning on the basis of the information gathered should concentrate on social and economic forecases and projects.

The most significant social change that should be anticipated is the steady growth in population. Within this change, area of residence, spatial concentration, and age distribution are significant factors. For economic analysis, stress should be placed on national economic conditions, income distribution, structure of income levels, amount of disposal income, leisure time, and mobility.

The basic questions that need answers in economic studies are: What is at stake? What should be done? And what approach should be taken?

The interrelationships among resources and their demand and uses need to be determined. Future economic study would provide data on present uses of known resources as well as provide a base for projecting future use and development of resources identified in the Phase III study. Using information provided by the study, management would then be able to set up priorities among uses of resources, and array alternative opportunities necessary for effective decision-making.

The major elements of such a study would include:

1. An input/output mathematical model.

2. Inventory and analysis of economic activity in the Desert and its relationship to economic activity outside the area.

3. Development of a profile of the resources supplied by the California Desert.

4. Development of a profile of demand variables, or uses of desert resources.

5. Projections of future economic activity in the Desert Area for the years 1980 and 2000, based upon assumptions of continued economic growth and development.

Conducting the Phase III Economic Study can be done either in-house by Bureau economists or under contract with an economic consulting firm. Considering the Bureau's present budget and manpower ceilings, it is doubtful that Bureau economists would be available for the period of time necessary to make the Study. For the purpose of this report, however, manpower and cost estimates are provided for both an "in-house" study, as well as contracting the study.

The Economic Study should start out at the same time resource inventories are started.

The Bureau should include economic analyses in other Desert studies. Economic evaluation should yield data that would be part of engineering design specifications in recreation planning. The aim of such studies would be to determine the maximum cost effectiveness and the highest benefit cost relationship.

Engineering and construction costs for the Chuckwalla recreation site were $67,270. The costs for recreation projects are normally amortized over a 20-year life expectancy at 3-1/4 percent. Assume that maintenance is 5 percent of cost annually and that the cost of a supervisor's time (half-time) is $7,000 per year. Annual equivalent cost is about $11,106. Assuming constructed facilities could accommodate normal daily visitors and at least one-half of heavy weekend use, 75 percent of the 23,000 annual visitor-days for 1968 could be valued at $1.50 per visitor-day, and 25 percent at $1.00. Value of annual benefit accruing was roughly $31,600, yielding a benefit-cost ratio of about 2.9:1 for the Chuckwalla site.

Afton Canyon project costs were $32,687. Again assuming 5 percent annual maintenance and one-half of a caretaker's time and costs amortized over 20 years, annual equivalent costs are $7,420.· Limited units (25 constructed unit) can be expected to accommodate no more than 10 percent of the estimated 42,000 annual visitor-days at maximum use. Another 15 percent may have access to limited use, and the remaining 75 percent limited to undeveloped use-patterns. Value of benefits are approximately $28,400, yielding a benefit-cost ratio of 3.8:1. The favorable benefit-cost ratios for the above recreation sites would indicate that a favorable or positive benefit-cost ratio for a total desert recreation management system would be realized.

It must be realized that values used are only approximations. Undoubtedly certain costs have been neglected and benefits are only estimates. But the basic premise is that recreation projects provide benefits to many people and deserve high priorities in budgetary allocations.

In Phase III of the California Desert Study and many programs resulting from it, benefit-cost ratios alone will be inadequate in selecting project priorities. Instead, early decisions covering the Desert System must also be made on the basis of cost effectiveness.

The question of charging a fee for recreational use is a case in point. Detailed economic analysis should be undertaken before selecting areas where entrance fees may be tried. Analysis should include accurate data on origins of visitors, distance traveled, average cost per user, and if recreationists would be willing to pay for facilities provided and if so, to what extent. Simple questionnaires may provide the best method of obtaining information. With valid data, it should be possible to make specific projections as to the impact resulting from fees.

Table 1.-- Population of Southern California counties and the State, 1960 and projected.

County	July 1 1960	Projected July 1 1970	Projected July 1 1975	Projected July 1 1980
Imperial	73,000	86,700	94,200	103,000
Inyo	11,700	11,900	12,100	12,400
Los Angeles	6,071,900	7,630,800	8,430,800	9,241,500
Orange	719,500	1,473,800	1,815,700	2,144,400
Riverside	311,700	506,200	610,000	722,000
San Bernardino	509,000	722,700	841,000	969,400
San Diego	1,049,000	1,407,700	1,593,000	1,800,100
Total	8,745,800	11,839,800	13,396,800	14,992,700
14 Southern Counties	10,087,700	13,846,500	15,779,300	17,804,400
California	15,863,000	21,734,000	24,830,000	28,137,000

Source: California Department of Finance

Table 2.-- Actual and projected changes in population in Southern California counties and the State, by decades 1960 - 1980.

County	Numeric Changes (all positive)			Percentage Changes (all positive)		
	1960-70	1970-80	1960-80	1960-70	1970-80	1960-80
Imperial	13,700	16,300	30,000	18.8	18.8	41.1
Inyo	200	500	700	1.7	4.2	6.0
Los Angeles	1,558,900	1,610,700	3,169,600	25.7	21.1	52.2
Orange	754,300	670,600	1,424,900	104.8	45.5	198.0
Riverside	194,500	215,800	410,300	62.4	42.6	131.6
San Bernardino	213,700	246,700	460,400	42.0	34.1	90.5
San Diego	358,700	392,400	751,100	34.2	27.9	71.6
14 Southern Counties	3,758,800	3,957,900	7,716,700	37.3	28.6	76.5
California	5,871,000	6,403,000	12,274,000	37.0	29.5	77.4

Source: California Department of Finance

Table 3.-- Changes in personal income in southern California counties and the State, 1961

County	Personal Income	Change 1947-1961	Change 1960-1961	Per capita Income	Families under $3,000
		percent	percent		percent
Imperial	$ 192,829,000	+ 90.4	+ 2.0	$ 2,541	21.1
Inyo	26,483,000	+ 143.0	+ 8.4	2,267	19.6
Los Angeles	18,887,757,000	+ 174.5	+ 4.7	3,028	12.6
Orange	1,865,284,000	+ 635.0	+ 15.6	2.335	11.1
Riverside	697,231,000	+ 234.6	+ 7.0	2,116	20.5
San Bernardino	1,115,470,000	+ 269.3	+ 7.3	2,111	17.1
San Diego	2,735,658,000	+ 279.8	+ 5.6	2,496	15.0
Total	25,520,642,000				
14 Southern Counties	28,804,989,000	+ 193.4	+ 5.7	2,748	13.4
California	45,586,000,000	+ 174.0	+ 5.7	2,771	14.1

Source: Research Department, California State Chamber of Commerce

Table 4.--Employment in Southern California - by type of work -- 1950-1960.

LOCATION	EXTRACTION			DISTRIBUTION		
	1950	1960	Percent Change	1950	1960	Percent Change
Imperial	8,519	10,893	+ 20	6,966	7,189	+ 3
Inyo	925	654	+ 3	1,592	1,399	- 12
Los Angeles	41,490	35,878	- 14	491,155	590,691	+ 21
Mono	189	79	- 58	172	211	+ 23
Orange	11,073	9,961	- 10	20,991	58,781	+180
Riverside	10,962	13,877	+ 27	16,312	26,621	+ 63
San Bernardino	10,315	9,470	- 8	30,582	45,217	+ 48
San Diego	13,207	9,934	- 25	49,458	74,737	+ 51
Santa Barbara	7,119	5,736	- 19	11,012	15,108	+ 37
Ventura	10,259	11,813	+ 15	10,972	15,557	+ 42
Total	114,058	108,295	- 5.1	639,212	835,511	+ 30.7

Source: California Department of Finance

Table 4.-- Employment in Southern California - by type of work -- 1950-1960
Continued from page 123

LOCATION	SERVICES			CONVERSION		
	1950	1960	Percent Change	1950	1960	Percent Change
Imperial	4,645	6,717	+ 45	2,649	2,523	- 5
Inyo	1,350	1,734	+ 29	889	724	- 11
Los Angeles	537,517	771,163	+ 44	530,194	852,993	+ 61
Mono	334	531	+ 59	314	191	- 39
Orange	20,007	71,361	+ 256	19,855	91,852	+ 360
Riverside	17,044	37,689	+ 121	9,288	23,691	+ 155
San Bernardino	27,344	62,683	+ 129	22,557	42,561	+ 89
San Diego	66,453	117,440	+ 77	37,591	97,843	+ 160
Santa Barbara	14,162	23,143	+ 63	5,016	14,126	+ 181.6
Ventura	13,815	24,535	+ 77	5,373	13,074	+ 143
Total	702,671	1,116,996	+ 59	633,276	1,139,308	+ 79.8

Source: California Department of Finance

Table 5.--Civilian labor force, employment and unemployment southern California labor market area, 1960 and 1966

Labor Market Area or County	Civilian Labor Force	Employment	Unemployment	Unemployment Rate %
Los Angeles-Long Beach				
1960	2,634,400	2,488,400	145,100	5.5
1966	3,064,900	2,924,100	139,100	4.5
Anaheim-Santa Ana-Garden Grove				
1960	211,900	199,500	12,400	5.8
1966	386,700	370,300	16,400	4.2
San Diego				
1960	330,100	309,000	21,100	6.4
1961	360,100	341,400	18,700	5.2
San Bernardino-Riverside-Ontario				
1960	268,600	251,000	17,600	6.6
1966	340,000	318,900	21,100	6.2
Oxnard-Ventura				
1960	72,800	68,700	4,100	5.6
1966	101,700	95,600	6,100	6.0

Source: State of California, Department of Employment

Table 6.--Total mineral sales in Imperial, Inyo, Orange, Riverside, San Bernardino, San Diego Counties, 1963-1967

MINERAL	1963	1964			
	Thousand dollars				
Sand & Gravel	29,229	30,313	30,237	34,336	37,408
Stone	12,353	15,098	15,919	16,885	16,974
Clays	2,608	2,933	2,641	1,759	1,983
Lead	177	404	561	569	455
Silver	161	199	220	217	209
Natural Gas	9,464	9,536	9,219	9,400	8,682
Nat. Gas Liquid	7,939	7,748	8,622	8,197	7,907
Petroleum	79,295	79,461	86,472	92,947	93,946
Talc	1,386	1,568	1,679	1,816	1,918
Unapportioned 1/	87,802	165,418	161,535	171,204	179,740
Total	282,123	312,778	317,076	337,311	348,843

1/ Includes boron minerals, copper, molybdenum concentrate, perlite, pumice and volcanic cinder, sodium carbonate, tungsten concentrate, wollastonite, zinc, gold, gypsum, lime, mica, salt, cement, iron ore, rare earths.

Source: California Division of Mines and Geology

Table 7.--Cattle and sheep in southern California, by counties, 1967 and 1968

	Cattle & Calves January 1		Stock Sheep & Lambs January 1	
County	1967	1968	1967	1968
Imperial	401,300	369,600	6,500	3,000
Inyo	21,000	22,000	200	200
Orange	40,500	41,300	200	200
Riverside	219,400	234,400	22,500	25,000
San Bernardino	109,000	105,400	9,000	11,400
San Diego	63,300	62,800	900	900
Sub Total	854,500	835,500	39,300	40,700
Los Angeles	168,700	153,900	30,900	27,700
Total	1,023,200	989,400	71,200	68,400

Source: California Crop and Livestock Reporting Service

COOPERATIVE RELATIONS

Each of the other sections that make up this part of the Report stressed the need for cooperative planning--and has suggested what should be done in developing plans. In this section, we focus attention on those areas of planning not covered by the other sections.

Our goal is to identify where the BLM needs to increase its cooperative activities in those areas with several levels of government involved. This section examines the nature of existing and proposed non-Bureau planning efforts that will affect BLM desert lands, other than those activities covered elsewhere in the Report; analyzes briefly the impact of this planning on BLM management programs; and assesses what additional planning efforts are needed to prepare a comprehensive plan for use and management of the California Desert.

GOVERNMENT PLANNING

Federal

If the Bureau is to launch a comprehensive desert planning program and make interim capital improvements, will there be any conflicts with the mission and responsibilities of other Federal agencies in the Desert? And what supporting role should the Bureau assume in helping these other agencies in reaching their National goals? As a resource management agency, the BLM is unique for it has both management and disposition authorities for public lands. Other Federal agencies usually lack authority to dispose of land. Some have no multiple-management authority. And some are oriented toward one or more function activities, such as sustaining or increasing agricultural production. And still others have solely regulatory or special service missions, such as prevention of pollution.

In the past, the Bureau has not taken the initiative to develop management of public lands and resources because its national policy was fragmented, and may not have been fully articulated. Consequently other Federal agencies have seized the lead in planning for the use of BLM desert lands and resources strictly on a functional or single-agency program basis and without relating the plans to the needs of other agencies. Now that the Classification and Multiple Use Act is law and BLM's Planning System Manual 1602 and 1603 clearly defines policy, the Bureau should undertake a cooperative desert planning and management program.

In a comprehensive planning effort for the Desert, the Bureau will be concerned with the plans and programs of:

- Department of Interior:
  - Bureau of Indian Affairs
  - Bureau of Mines
  - Bureau of Outdoor Recreation
  - National Park Service
  - Bureau of Reclamation
  - Federal Water and Pollution Control Administration
  - Fish and Wildlife Service
  - Geological Survey
- Department of Agriculture:
  - Forest Service
  - Soil Conservation Service
- Department of Defense:
  - Department of the Air Force
  - Department of the Army
  - Department of the Navy
- The Department of Health, Education, and Welfare
- The Department of Transportation
- The Department of Housing and Urban Development
- National Aeronautics and Space Administration

State

More than any level of government involved in the Desert Study Area, the State of California has unique capabilities to influence planning for growth, development, and public welfare. It has the statutory power to provide for local units of government; to determine and control the taxing authority of its political subdivisions; and to define the relationships between

Federal and state agencies, state and local governments, and between all government levels and the private sector.

Over time, and because of a strong tradition of home rule prevailing throughout California, the State has delegated much of its direct powers over development to local governmental entities and now exercises its influence indirectly over these local levels of government, primarily through grants or conveyances of land or other resources and through its legislative powers to encourage or control the actions of regional or local units and the private sector. Even in the area where the State takes direct action, such as the programing and construction of public works, most of the projects involved are undertaken within the context of limited objectives, i.e., provision of highways, water supply, etc., and are not used as instruments of overall or regional development policy.

Similar to the national level, there is a proliferation of state agencies in California that are responsible for a variety of functional activities and programs, many of which activities and programs will affect how the BLM plans for and manages the desert area. Some of these state agencies establish statewide standards and policies concerning California's natural resources, some establish land and resource controls that affect both government owned and privately owned lands, and others are oriented towards providing public services in a variety of fields such as health, education, business, transportation, and planning. The key agencies are:

State Resources and Development Agency

State Business and Transportation Agency

State Department of Finance

Human Relations Agency

Coordinating Council for Higher Education

Local

BLM policy requires the encouragement of well-planned private land use patterns by strongly supporting and encouraging local government land use planning. It further requires that the Bureau assist in the development of land use plans that are responsive to regional needs. The Bureau has gone on record in recognizing that local government should have an effective voice on the classification and disposition of public lands.

Without a doubt local governmental entities within the Desert Area boundaries should actively participate in a BLM comprehensive planning effort.

The California Desert is either within or adjacent to the jurisdiction of some of the most advanced and sophisticated local planning agencies in the State. Five counties lie within the Desert Study boundaries: San Bernardino, Riverside, Imperial, Kern, and Inyo. In addition, the intensively populated counties of Los Angeles, Orange, Ventura, and San Diego have a major impact on the use of the Desert. All of the counties within the Desert have active planning commissions and planning departments.

County planning and zoning in the three counties comprising the bulk of the Desert Study Area varies. San Bernardino and Riverside counties have a completed and approved general (master) plan of land use. Imperial County has yet to complete a county-wide comprehensive land use plan. The planning departments of all of these counties are either in the process of completing general and detailed plans or reviewing and updating master plans. Degree of zoning according to the plan is: San Bernardino, 25 percent; Riverside County, 17 percent; Imperial County, 50 percent. San Bernardino and Riverside Counties have also prepared master plans for recreation and highways.

A number of cities within the desert counties have comprehensive land use plans. The preparation of some of these plans was or is now being financed in part by planning grants from the Department of Housing and Urban Development.

In the major desert counties--San Bernardino, Riverside and Imperial--there are hundreds of functionally varied special districts. The statutory boundaries and responsibilities of these districts will have to be determined by the BLM so it can assess what impact they have on desert land use.

To solve problems that have a regional implication, six southern California counties have banded together and formed a regional planning commission called the Southern California Association of Governments (SCAG). This regional agency is a voluntary membership organization involving Ventura, Los Angeles, San Bernardino, Riverside, Orange, and Imperial Counties and a number of cities therein. SCAG has no implementing authority to carry out its recommendations.

PROBLEMS

The Bureau of Land Management is actively classifying its desert lands for either multiple-use management or for disposal. It works closely with local governments to identify the needs of local communities for public land and resources and has sought local opinion and support for its classification decisions.

Zoning

If land is determined as suitable for transfer from Federal ownership, the BLM has encouraged local government to prepare comprehensive plans and adequate zoning regulations for the land. Yet, the Bureau has not explored the preparation of joint county-BLM comprehensive plans and zoning regulations for lands to be retained in Federal ownership and managed for multiple-use. It has, to date, lacked the planning and zoning expertise, time and funds to do so.

The lack of more intensive zoning on Federal lands can lead to inequities in county regulation of uses that are similar on private and public lands. Such inequities destroy the intent of sound master planning and zoning in a local area. Two of the largest counties in the Desert (San Bernardino and Riverside) already have zoned public lands in a broad land category.

The Bureau should begin a pilot effort, in cooperation with a county, aimed at zoning public lands that are to remain in Federal ownership in the Desert. It should consider establishing zones that identify flood plains, potential mineral development areas, critical wildlife habitat, waste disposal sites, archaeological and historical areas, proposed transportation routes, potential urban areas, and public facilities sites. And it should adopt regulations necessary for the use and protection of these areas. In this way, BLM could encourage sound planning that is consistent with local, regional, and national needs. It would secure local support for proposed land uses in the Desert. Joint planning and zoning would also increase the effectiveness of the local administrators in planning for the entire county and would lend additional support for BLM land classification decisions.

San Bernardino County has expressed interest in undertaking a joint planning and zoning effort with BLM for the desert lands within county boundaries. The BLM should review this proposal with the Department of Housing and Urban Development (HUD) to determine the availability of funds to finance the county's effort.

Open Space

The State has recently completed a study of the open space requirements of the State's largest urban-metropolitan regions. The study identifies more than 669,000 acres of BLM desert land as suitable for open space, but such land was not considered as permanent open space. It is subject to disposal for a variety of uses not consistent with the definition of open space. The study recommended purchase of these and private lands for open space purposes by the state and by Federal agencies.

In light of the recognized impact BLM desert lands now have and will have on southern California's open space needs, the

Bureau should work with State and local planning agencies to identify those Desert public lands that should have open space designation, to determine the permissible uses that could continue in these areas without destruction of the open space environment, and to develop the controls needed to preserve those public land areas from destruction and deterioration by incompatible uses.

Waste Disposal

Another recent State study on the status of solid wastes identifies the massive quantity of wastes produced and unsatisfactorily disposed of every year in southern California. The two Counties of Los Angeles and San Bernardino rank first and third in solid wastes production in the State (12,645,000 tons and 3,169,000 tons respectively.)

The State Department of Public Health has warned of the need for more disposal sites, improved waste disposal technology, better planning, and more realistic waste management practices. Without a concerted effort to carry out an effective waste management program, flies and rodents will increase, air will continue to be polluted from widespread waste burning, water supplies will be endangered, open dump and junk piles will continue to blight the landscape and create fire and safety hazards in urban areas--all contributing to a deteriorating environment--and all adversely affecting the health and general welfare of southern California residents.

Most of the existing disposal sites in the Southern California area are located in relatively underdeveloped areas, away from urbanized high-priced land. One of the principal disadvantages of landfill disposal is that close-in suitable land is increasingly difficult to locate and acquire. BLM can expect the search for additional remote disposal sites will encompass the desert lands.

If the Bureau is to manage and protect the desert environment, it must determine what impact solid waste disposal plans would have on its multiple-use programs. In cooperation with state and local agencies BLM should develop a solid waste policy for its desert lands that is consistent with other Federal, state and local policies. It should also develop sound waste disposal practices for its own operations on the public lands. Further, it should support and encourage the State's effort to develop coordinated solid waste planning on regional and local levels.

PLANNING CONSIDERATIONS

Determinations

The following is not complete listing of what BLM must consider in a cooperative planning effort for the desert. But the Bureau should at least determine:

. The compatibility of military withdrawals with the location of new access routes across Bureau lands and the construction of recreation and other facilities by the Bureau and other agencies on these lands.

. The anticipated future special uses that the military services will make of desert lands outside the boundaries of various land withdrawals, and their possible conflicts with other programs.

. The hazards that may be created by constructing new access routes near restricted military areas, new access routes in highly mineralized areas that may be subject to future indiscriminate mining activities and capital improvements in geologically unsafe areas.

. The additional administrative costs that may be imposed on other agencies because of BLM opening up previously inaccessible areas to intensive public use (problem of trespass, fire protection, and the need for additional facilities).

. The total short-term (5 years) and long-term (1980) use and construction programs other Federal agencies intend to undertake on BLM desert lands, so that the Bureau can assess their impact on its own programs, can prevent loss of lands through its classification program, can prevent or reduce duplication of efforts by agencies, and can determine the administrative workload needed to prevent encroachment by incompatible uses.

. The environmental protection standards that should apply to BLM management programs in the desert. Such standards can be a problem when other Federal agencies and state and local governments have not articulated national, statewide, regionwide, or countywide policy and procedures for protection of urban and rural environments.

Alternatives

The Bureau should explore several alternatives for coordinating its planning with the planning of all Federal agencies. The alternatives include cooperative planning: (a) under the aegis of the Department of Interior's Coordinator; (b) through the Pacific Southwest Interagency Committee which is concerned with coordinating the planning of many Federal agencies involved in the comprehensive framework river basin studies for the California region; (c) by working independently with each agency; (d) by creation of a Desert Land Advisory Committee which would consider the interrelated plans of all Federal, state,and local agencies and recommend plans to the Bureau; or (e) a combination of these alternatives.

Several alternatives for cooperative planning between the BLM and the State should be explored in Phase III of the Desert Study. These include planning (a) through individual state agencies; (b) through the State Council on Intergovernmental Relations; (c) by inclusion of state representatives on a desert land advisory committee; (d) by formation of ad hoc committees to study and solve specific problems; or (e) by a combination of the alternatives.

Because of the numerous and diffuse local planning organizations operating in and around the Desert Study Area, the Bureau will be faced with a massive undertaking in cooperating with such groups in developing a comprehensive plan. Some of the alternatives that the Bureau must explore for cooperative planning are: (a) working with each local level individually; (b) working through SCAG and its membership; (c) creation of a desert land advisory committee with appropriate representation thereon by local agencies; (d) working through a multi-county group that represents all local planning levels (no such group exists at present); or (e) a combination of these alternatives.

Related Programs

A number of related statewide and regional plans and programs will have an effect on developing a comprehensive desert plan. The Bureau will need to work with appropriate agencies to assess its role in cooperating with and supporting these programs.

1. Airport facilities needs of the southern California Area, particularly around the Los Angeles metropolitan area. If BLM desert lands are considered as having potential for airport facilities location, the BLM will have to consider the impact of such construction on the public land and resources.

2. Identification and reservation of industrial potential areas in the Desert which revolve around the availability of minerals, water and power. In cooperation with the State Division of Mines and Geology, the BLM should seek to identify those desert areas with mineral deposits of value that will be needed in the future.

3. Developing public-land category classification codes with the State Office of Planning that will be compatible with the ones developed by the Southern California Association of Governments.

4. Development of a joint BLM-state lands use policy that will identify the role of BLM and the state in developing, managing, and preserving the desert environment.

5. Expansion of the state effort at photomapping in southern California to include the Desert Area. The BLM should identify where the state has progressed in its photomapping program and undertake additional coverage of the Desert at a similar scale.

6. Inventory of special study programs underway in the southern California area which may have an impact on the Desert.

Minerals constitute one of the principal resources of the California Desert. Production of this resource now amounts to some $160 million per year and is expected to reach at least $300 million by 1980.[1] This is the basic value of the raw mineral as it comes from the ground. In final, refined or converted form raw minerals become even more valuable. This mineral production has a multiple effect--a gross economic impact now of some two-thirds of a billion dollars on the Nation.

POTENTIAL VALUES

The Desert Area has the State's greatest potential for future mineral production. Several reasons account for this condition: (a) extensive areas of contact or zones between the intrusive granitic rocks and old metamorphic-sedimentary rocks that are often quite favorable environments for the concentration of metallic minerals; and (b) vast areas deeply covered by alluvial fans that completely bury the rock formations which often are host to ore bodies.

Heretofore, deeply buried ore deposits have been rarely found and explored. But today, with the modern instruments and tools of the geophysicists, the discovery of these ore bodies is no longer a rarity. Until the early 1940's, most mineral discoveries were made by bearded surface-plodding prospectors who would hit upon an outcrop. Today, discoveries are made by geologists and geophysicists who use highly sophisticated, scientific instruments. They either operate from planes, helicopters, or motor vehicles.

Yet with all of the potential present, California has surprisingly declined from pre-eminence as a great metal mining state. This decline is attributed to a lack of modern exploration programs and geophysical surveys. To a considerable extent this lack can be attributed to the problem of title pollution created by spurious mining claims and to the reaction of conservationists concerned with the surface destruction of some mining operations.

MINERAL RESOURCE MANAGEMENT

General

Broadly speaking, minerals fall into three general categories: Leasable - Salable - and Locatable.

The leasable minerals are administered under the Acts of 1917 and 1920, and include coal, petroleum, oilshale, phosphate, and sodium salts. In the Desert Area, they pose a minimum of administrative problems. The prime consideration in leasing minerals is the effect their mining or removal will have on the environment. Generally speaking, any effects can be controlled by stipulations incorporated into the lease, and field inspections to guarantee that agreements are fulfilled.

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[1] U. S. Bureau of Mines

The salable minerals include such non-locatable (not subject to location by mining claims) minerals as sand, gravel, building stone, cinder, crushed rock, and fill material. The administration of these mineral materials can be relatively simple except when they are found on lands already under mining claims. In such instances, the mining claim clouds the title of the land and, in effect, prevents the disposal of the salable minerals until the Bureau of Land Management has spent considerable time and effort in determining the validity of the claim. Should a mining claim for a locatable mineral be valid, the claimant would, of course, be entitled to acquire full title to the land, including the total mineral estate. This action would preclude disposal of the salable minerals by the Bureau of Land Management.

Recent court decisions (Coleman) have enabled the government to proceed on many pending contest proceedings, however, common variety minerals under mining location still remain a major problem to resolve.

From existing information we estimate that there are approximately 250,000 located mining claims on the Desert which almost entirely blanket those areas containing salable minerals. Only a small percentage of these claims are considered valid, but it would be impossible for the BLM to attempt to remove the cloud of invalid claims from salable mineral sites in a timely manner. One consequence would be the problem of trespassing on property. This problem has further complicated mineral resources administration and detracts from the BLM's capability to satisfy legitimate demands of the mineral industry.

The basic mining law of 1872 was geared to the outcropping fissure-type of vein found in the Mother Lode area of California. The fundamental principle of the law is that the locatable minerals are free and subject to location.

Today, mineral discoveries are principally limited to the large, low-grade subsurface type of deposits. Oftentimes there is no surface manifestation of such a deposit, and its discovery is time-consuming, laborious, and expensive. Exploring such subsurface deposits requires the work of geologists and engineers whose work is readily discernible to the general public. Individuals or organizations making geophysical or other types of explorations may be subjected to the harassing or nuisance type of mining claims. To protect themselves against such harassment by the opportunist, they have found it necessary to blanket a large area with mining claims in order to proceed with their exploration work and to protect any discoveries they should make. This expensive and illogical procedure has been forced on the legitimate operator and industry. The need for prediscovery protection has been long recognized by both industry and the government.

Title Conflicts

Probably the biggest obstacle facing the Bureau in its efforts to build a mineral sales program is title conflicts with old or inactive mining claims.

There are an enormous number of mining claims on the desert area. Based on past experience it is believed that most of them-- more than 95 percent-- are illegal and invalid because of their lack of a mineral discovery. Often, mining claims have been located two or three deep on a given parcel of land-- all without a valid discovery. The location of a mining claim on public domain is the assertion of an interest to and right in minerals embraced within the boundaries of the claim. To extinguish these rights in invalid mining claim locations is a costly and time-consuming procedure.

A typical example of the harassment type of claim is found at Calico. Immediately after a large mining company started exploration work, large numbers of mining claims were made on land surrounding the claims of the company. These claims include not only lode locations in the hills, but also placer locations of 160 acres each on the alluvial fan in the valley. In practically every case, these claims are invalid and were located by speculators who wished to capitalize on the company's development. The location of a mining claim, even though invalid, still implies a right in the land.

Of the estimated 250,000 mining claims of record in the Desert Area, about 75,000 were located after 1955. [1] Today, some 25,000 are being actively held, probably not more than 500 of them would meet the test of validity. The basic concept of the 1872 mining law that only a discovery will be located is seldom met. Several factors account for this situation. The prime factor is competition for minerals, for land, and for money. In the competition for minerals, when it becomes known that a valuable mineral has been discovered in a given area, people rush in and stake mining claims on all unlocated land. In many instances they even stake claims on top of known locations-- often in hope of creating a claim which will have nuisance value to the valid discovery, by

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1/ Mineral Resource Inventory, Riverside District blocking access or creating a claim that can be promoted and sold to the unknowing.

Conflicts in Use

Preliminary data indicates that the conflict of legitimate mining operations with other uses of the desert lands is actually at a very minimum. Such mineral operations will never occupy more than a small portion (56,000 acres) of the Desert Area. [1] That vast acreage that is now covered by mining claims is not all mineral land or land used for mining operations. It is the pseudo claims that really conflict with those other uses, such as grazing, timber production, wildlife, urban expansion, and recreation.

Embraced within these pseudo or spurious claims are vast acreages of land wherein the majority of the uses of other resources are greatly restricted. Water holes and springs are occupied to the exclusion of wildlife, access to other public lands are denied the public, legitimate mineral exploration is prohibited and livestock grazing is hampered.

Mining and recreation are often considered to be in direct conflict, but many instances are found where these two uses of the land are compatible. Today, the mining industry is most cognizant of its impact on the environment and the needs of the public. As a result, industry is becoming most responsible and cooperative. [2] Conflicts between recreation and mining are actually at a very minimum. The principal conflicts are between the recreationist and the spurious mining claim. A typical example of such a conflict was recently observed at the Kelso Sand Dunes. These sand dunes, which are a principal recreation area for the general public, were covered with placer mining claims. The area was posted with "No Trespassing" signs in an endeavor to exclude the general public from 35,000 acres of prime recreation land. These sand dunes have been studied by numerous agencies including BLM and are definitely non-mineral land.

Mining, whether it be in the past or present, has a very strong appeal to people. Among the many examples of present day mining operations that attract tourists by the thousands is the Utah Copper Pit at Bingham Canyon, Utah. Here, tourists view a tremendous copper mining pit which terraces the side of a major mountain range. The pit, 2 miles in diameter at the top and as deep as two Empire State Buildings, was created by man, who has removed billions of tons of rock (and ore). Among the old mining operations of the West, dozens today are proving to be tourist meccas and centers of recreation. Park City, Utah, one of America's finest ski areas, is built around the old Park City Mines. The

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1/ U.S. Bureau of Mines, River Basin Studies, 1969

2/ American Mining Congress

lower mine tunnel takes the skier under the mountain and the hoist takes them to the top of the ridge. Aspen, Colorado, an old lead-silver mining camp, is a first quality ski resort in winter and a nationally known center for the performing arts in summer. The Death Valley National Monument today features the borax mining camps as an important attraction. And as a final example, the old Malakoff Hydraulic Mine is now a California State Park.

With a realistic mineral management program, mining can greatly complement a public recreation-tourism program.

Many families, while driving down a highway and viewing a parallel desert mountain range, will spot an old abandoned mine on the hillside. Their usual reaction is to stop and view the weathered buildings, worn foundations, and mine headframes. They are attracted by the old multihued rock dumps which, in many instances, are rockhound delights. When there is such a change in the desert landscape and it attracts people, it may be considered an added resource, a scenic enrichment.

Within the desert area are large areas in non-federal ownership in which all or a portion of the mineral interest is reserved to the United States. Under the Stock-Raising Homestead Act of December 29, 1916, a claimant may locate and work the mineral estate in accordance with mineral laws. He can enter and occupy as much of the surface as may be required for all purposes reasonably incident to the mining or removal of the mineral.

Under the Recreation and Public Purposes Act and the Small Tract Act, all minerals are reserved to the United States but the lands are not open to mining or mineral leasing unless or until regulations are issued. At the present time there are regulations to permit mineral leasing on these lands.

Under the Anza Borrego Desert Park Act of 1936, all minerals are reserved to the United States but the prospecting and development of all minerals are handled under special leasing regulations.

The administration of reserved mineral interests involve many complex relationships and require similar consideration of environment controls that are now becoming more significant on the public lands.

PLANNING

Inventorying

Phase III of the Desert Study will require the gathering of detailed minerals resource information from BLM field studies, from studies and data developed by other federal, state and local agencies, and from conferences with the minerals industry. This inventory will identify given mineral areas and can be used to evaluate the relative importance of the areas to a BLM minerals management program, to industry's needs for certain minerals. From the information the BLM can determine the compatibility of potential mineral areas to other types of resource development and uses. Thus, a priority sequence of minerals work can be established by the Bureau when it attempts to carry out the elements of a comprehensive plan of management for the desert. Those mineral areas having the greatest conflicts and values should be investigated first in a comprehensive planning effort.

Minerals information can be gathered for documentation and statistical analysis on a county basis or on the planning unit basis or both. A planning unit is the land area used for inventory and planning purposes in the BLM Planning System Manual (1601). It refers to that land area that the Bureau considers a logical planning and management entity because of distinct topographical boundaries and resource characteristics.

An important part of the BLM minerals inventory and planning activities will be joint efforts with the State Division of Mines and Geology and the mineral industry to evaluate the impact of developing new mineral areas. This work might involve identification of extremely valuable or rare mineral locations, setting aside of these mineral sites to preclude certain incompatible uses from encroaching on the sites making mineral development overly costly to industry or hazardous to other uses, and developing regulatory measures acceptable to industry, local and state governments and the BLM.

Cooperative efforts will also have to be directed toward identification of mining hazards from active and abandoned mining claims and mining operations. And work should be done to determine what can and must be done to restore abandoned exploration and mining sites to conditions of practical usefulness or reasonable physical attractiveness. In addition, a cooperative assessment is necessary to determine where a desert road system should be located to provide access for the exploration and removal of leasable and salable mineral products without destroying desert environment values and to provide multiple access for such other desert uses as recreation, administration, and fire protection through access for highways and other right-of-way purposes. Road standards will have to be determined for the mainline roads used for hauling of minerals and for the spurs needed for exploration and removal of minerals to mainline roads, when the BLM or other agencies or private industry intends to construct roads in adjoining areas actively being mined or having a potential for mining, and the roads which will be heavily traveled. Developing a road system that would satisfy multi-desert uses is imperative to prevent despoilation of desert vegetation and scenery, and to prevent drainage and soil erosion problems created from unplanned and uncontrolled road locations.

Investigating

To date the mineral resource potential of California, including the Desert Area, has not been adequately explored and evaluated. There has been no government-sponsored resource surveys from the air, no interpretation of aerial photos on a state-wide scale, and no significant geophysical surveys. Only a fraction of the geologic mapping coverage is on a scale (1:62,500) needed in mining.

Concurrently with the field examination of the mining claim conflicts and the resolution of the title encumbrance, the Bureau should make a complimentary geologic-geophysical survey of the mineral potential. This survey should be in such detail that it will call attention to potential of the mineral resource and attract private capital in further exploration and development.

This approach to the stimulation of resource development has been used by many agencies and governments, including the United Nations. It has been most successful in many instances and the economic benefits can be substantial and long lasting. Classic examples of the results of geologic-geophysical programs are found in Canada and in Europe. The geologic-geophysical survey should use the most advanced airborne censors, including those developed by the National Aeronautics and Space Administration along with the magnetometer, electro-magnetometer, and gamma ray spectrometer. Included in the program should be a computerized exploration evaluation service.

Since the Bureau is not geared to conduct such specialized work with its available expertise, a series of coordinated contractual arrangements could be made to accomplish the program. The program should include the California Division of Mines and Geology, U. S. Geological Survey, University of California Department of Mineral Technology, the National Aeronautics and Space Administration (Earth Resource Division), and the U.S. Bureau of Mines.

PROGRAM-ALTERNATIVES

Requirements

Any proposed minerals program must benefit the general public, the land or surface owner, as well as the mining industry. Furthermore, it should be administratively acceptable to the BLM.

For such a program to be basically beneficial to the public, it must (a) provide minerals for the general economy of the country; and (b) protect the overall desert environment.

For such a program to meet the requirements of industry, a minerals program must (a) respond to the principle of the basic mining law of 1872; and (b) create an environment in which the industry can operate with confidence and free from harassment.

For such a minerals program to be acceptable to the land or surface owner and BLM, it must (a) provide for ease and economy of administration; and (b) be compatible with other resource programs and surface uses.

Can all these basic requirements under present laws and Departmental regulations be met in the Desert Area? Until the third phase of the Desert Study is completed we can only suggest possible approaches.

Alternatives under Existing Law

With the public's insatiable need for minerals, the basic law of 1872 has sought to encourage the development of mineral resources. The protection of the environment has usually been attempted by the "withdrawal" of the land from prospecting and mineral entry. In most cases, non-mineral land has been withdrawn. The real purpose of these withdrawals often is to protect the land from land promoters and the pseudo miners with their spurious claims. The mining industry is not interested in making mineral locations on non-mineral land. It therefore follows, that many withdrawals need never be made in the first place. Seldom are mineral lands withdrawn and only in those limited cases when other values are extremely high.

To retain the basic mining law of 1872 and meet these general requirements, supplemental legislation is required. The Secretary of the Interior on August 29, 1969, outlined broad general guidelines which appear necessary for accomplishment of our present day objectives of mineral development, conservation, and well-balanced multiple use management of the public lands. Suggested changes were:

1. Revision of the patenting procedures to grant claimants only a patent to subsurface mineral resources with a right to use so much of the surface as is necessary for mining and related activities. Preference should be given to the patentee in any sale of the remaining surface rights.

2. Provision for realistic increases in the purchase price per acre for mining claims upon patenting. Such increases should adequately reimburse the Federal Government for expenses incurred in issuing the patents. Prices established in 1872 are far from in line with prices of today.

3. Retention by the United States of surface rights should be accompanied by a provision enabling the Federal Government to exercise a reasonable degree of control over the impact upon the surface and environment as a result of mining and related operations.

4. Elimination of the distinction between lode and placer claims. Countless problems have been caused by this needless distinction and it is generally agreed that it serves no useful purpose.

5. Establishment of a means to clear the public land of stale and abandoned mining claims. The present system is ineffective and extremely expensive. As a result, very slow progress has been made in clearing public land of questionable claims which adversely affect both the mining industry and the public interest.

6. Elimination of local laws and customs for the regulation of claims locations and the establishment of clear and modern federal requirements applied uniformly which recognize the technological developments made in the mining industry. These regulations should require claim locations to conform to the lines of public survey and follow the description of legal subdivisions as closely as possible.

7. Elimination of extralateral rights. Amend existing laws to provide that mining claims only include minerals within the vertical extensions of claim boundaries.

8. Establishment of a system of prediscovery claims subject to reasonable requirements for time of development. This should provide necessary protection for one engaging in exploration with reasonable diligence intending to develop any workable deposits found.

The location of mining claims for purposes other than mining is one of the Bureau's most perplexing and expensive problems.

A minerals program for the Desert could be a testing ground for methods and procedures responsive to the Secretary's guidelines.